

## PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

Date of mailing (day/month/year) 06 April 2000 (06.04.00)
Applicant's or agent's file reference P79844WO
International application No. PCT/GB99/02394

To:  
 AUSTIN, Hedley, William  
 Urquhart-Dykes & Lord  
 Alexandra House  
 Alexandra Road  
 Swansea SA1 5ED  
 ROYAUME-UNI

## IMPORTANT NOTIFICATION

International filing date (day/month/year)  
23 July 1999 (23.07.99)

## 1. The following indications appeared on record concerning:

the applicant     the inventor     the agent     the common representative

Name and Address  SYMONSON, William, Oliver, Christian Gallt Hyfryd Pontfadog Llangollen Clwyd LL20 7AG United Kingdom	State of Nationality GB	State of Residence GB
	Telephone No.	
	Faxsimile No.	
	Teleprinter No.	

## 2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

the person     the name     the address     the nationality     the residence

Name and Address  SYMONDSON, William, Oliver, Christian Gallt Hyfryd Pontfadog Llangollen Clwyd LL20 7AG United Kingdom	State of Nationality GB	State of Residence GB
	Telephone No.	
	Faxsimile No.	
	Teleprinter No.	

## 3. Further observations, if necessary:

## 4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No.: (41-22) 740.14.35	Authorized officer  H. Zhou  Telephone No.: (41-22) 338.83.38
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M/1

## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION  
(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
 United States Patent and Trademark  
 Office  
 Box PCT  
 Washington, D.C.20231  
 ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 10 March 2000 (10.03.00)	To:  Assistant Commissioner for Patents United States Patent and Trademark Office Box PCT Washington, D.C.20231 ÉTATS-UNIS D'AMÉRIQUE
International application No. PCT/GB99/02394	Applicant's or agent's file reference P79844WO
International filing date (day/month/year) 23 July 1999 (23.07.99)	Priority date (day/month/year) 23 July 1998 (23.07.98)
Applicant  SYMONSON, William, Oliver, Christian	

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:

18 February 2000 (18.02.00)

in a notice effecting later election filed with the International Bureau on:

\_\_\_\_\_

2. The election  was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No.: (41-22) 740.14.35	Authorized officer  Juan Cruz  Telephone No.: (41-22) 338.83.38
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## PATENT COOPERATION TREATY

10/009948

PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

HUNTSMAN, Peter  
 Davies Collison Cave  
 1 Little Collins Street  
 Melbourne, VIC 3000  
 AUSTRALIE

**RECEIVED**  
**JUL 17 2002**  
**Technology Center 2600**

Date of mailing (day/month/year) 03 January 2002 (03.01.02)	
Applicant's or agent's file reference 2301450/PHH	<b>IMPORTANT NOTIFICATION</b>
International application No. PCT/AU00/00652	International filing date (day/month/year) 09 June 2000 (09.06.00)

## 1. The following indications appeared on record concerning:

the applicant       the inventor       the agent       the common representative

Name and Address  N & V CURIE PTY LTD and CURIE, Napoleon	State of Nationality	State of Residence
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

## 2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

the person       the name       the address       the nationality       the residence

Name and Address  46 Highland Drive Frankston Victoria 3199 Australia	State of Nationality	State of Residence
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

## 3. Further observations, if necessary:

The address of both applicants has changed as indicated in box 2.

## 4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No.: (41-22) 740.14.35	Authorized officer  Athina NICKITAS-ETIENNE  Telephone No.: (41-22) 338.83.38
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S/H

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

Not in IPAS - now entered

To:

ALLEN, D.  
SIEMENS SHARED SERVICE LIMITED  
Intellectual Property Department  
Siemens House  
Oldbury  
Bracknell  
Berkshire RG12 8FZ  
GRANDE BRETAGNE

PCT

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing (day/month/year)	28.09.2001
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Applicant's or agent's file reference

1999P04823 - R76 - EHE

IMPORTANT NOTIFICATION

International application No.  
PCT/GB00/02394

International filing date (day/month/year)  
19/06/2000

Priority date (day/month/year)  
25/06/1999

Applicant  
ROKE MANOR RESEARCH LIMITED

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

**4. REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/

European Patent Office  
D-80298 Munich  
Tel. +49 89 2399 - 0 Tx: 523656 epmu d  
Fax: +49 89 2399 - 4465

Authorized officer

Le Nadan, M

Tel. +49 89 2399-2350



**PATENT COOPERATION TREATY**  
**PCT**  
**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**  
**(PCT Article 36 and Rule 70)**

Applicant's or agent's file reference  1999P04823	<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No.  PCT/GB00/02394	International filing date (day/month/year)  19/06/2000	Priority date (day/month/year)  25/06/1999
International Patent Classification (IPC) or national classification and IPC  H04J11/00		
Applicant  ROKE MANOR RESEARCH LIMITED		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

- I     Basis of the report
- II    Priority
- III    Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV    Lack of unity of invention
- V    Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI    Certain documents cited
- VII    Certain defects in the international application
- VIII    Certain observations on the international application

Date of submission of the demand  15/01/2001	Date of completion of this report  28.09.2001
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Moser, J  Telephone No. +49 89 2399 7528



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/02394

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

### Description, pages:

1-3,6-11	as originally filed		
4,5	as received on	02/08/2001 with letter of	01/08/2001

### Claims, No.:

1-10	as received on	02/08/2001 with letter of	01/08/2001
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### Drawings, sheets:

1/3-3/3	as originally filed
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2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/02394

- the description, pages:  
 the claims, Nos.:  
 the drawings, sheets:

5.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*  
**see separate sheet**

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims 1-4
	No:	Claims 5-10
Inventive step (IS)	Yes:	Claims 1-4
	No:	Claims 5-10
Industrial applicability (IA)	Yes:	Claims 1-10
	No:	Claims

**2. Citations and explanations**  
**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/02394

**Re Item I**

**Basis of the report**

The amendments filed with the International Bureau under Article 19(1) introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 19(2) PCT. The amendments concerned are the following:

Claim 1 specifies that data is encoded according to the Channelisation code, "*with a spreading factor dependent upon the selected Channelisation Code*".

This is in sharp contrast to the description on page 7, which specifies that "*a single spreading factor is always used*" in the uplink mode of operation (see lines 10 to 15). Furthermore, support for this specification could not be found in the description or the claims as originally filed.

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. If the clarity problem present in claims 1 and 3 were overcome in accordance with section VIII, in particular if all features essential to the definition of the invention were present in claims 1 and 3 (see section VIII), the solution proposed in the resulting claims would be considered to involve an inventive step according to Article 33(3) PCT for the following reasons:

The present invention proposes a possibility of determining the Channelisation code upon detection of the Training code in code-time division multiple access systems. In these systems, a number of users are permitted to transmit data sets during the same time slot. Each data set in a given time slot is separated by code division.

The association scheme of Channelisation code, spreading factor and Training code in the present invention is such that the Channelisation code can be unambiguously determined if the spreading factor and the Training code are known.

In an uplink mode of operation (defined in claim 1), a single spreading factor is always used by the mobile terminal. As the Training code is transmitted with the data, the Channelisation code can be determined at the receiving side and the data can be decoded.

In a downlink mode of operation (defined in claim 3), Channelisation code, spreading

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/02394

factor and Training Code are chosen by the base station. The mobile station is able to determine the spreading factor used by the base station by detecting the order the Training codes are received from the base station. The Channelisation code can then be determined as a function of the Training code and the spreading factor.

The solution according to the present invention makes sure that the receiver knows the number of Channelisation codes active in a given time slot while at the same time avoiding the overhead required by broadcasting this information to all users.

The documents cited in the International Search Report neither disclose nor render obvious the solution defined in present claims 1 and 3.

2. The solutions proposed in dependent claims 2 and 4 would also be considered inventive (Article 33(3) PCT) in combination with independent claims according to paragraph 1 in this section.

3. Independent claims 5 to 10 define several telecommunications systems and devices "*operable in accordance with the methods as claimed in any of Claims 1 to 4*". This is interpreted as being equivalent to the formulation "*suitable for carrying out the methods as claimed in any of Claims 1 to 4*", i.e. as a non-limiting feature.

It is furthermore considered, that known systems and devices (e.g. base stations and UMTS mobile telecommunications systems) are equally suitable for carrying out the methods as claimed in any of Claims 1 to 4, because the communication channels necessary for exchanging communication parameters are known to be available in these systems.

Independent claims 5 to 10 are therefore not considered to meet the requirements of Article 33(2) PCT.

It is however noted that, at least in accordance with the regulations in certain designated states, a formulation imposing clear limitations on the claimed system like e.g. "*A Code-Division Multiple Access mobile telecommunications system comprising means for carrying out the steps of the method according to anyone of claims 1 to 4*" could have been considered novel and inventive (Article 33(3) PCT) in combination with novel and inventive method claims 1 to 4 according to paragraph 1 in this section.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/02394

**Re Item VIII**

**Certain observations on the international application**

It is clear from the description and the drawings that the following features are essential to the definition of the invention:

- (1) the association scheme of Channelisation code, spreading factor and Training code is such that the Channelisation code can be unambiguously determined if the spreading factor and the Training code are known (see figures 2 and 3 and related passages in the description)
- (2) a single spreading factor is always used in the uplink mode of operation

Since independent claim 1 does not contain these features, and independent claim 3 does not contain feature (1), they do not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

The absence of the above-mentioned features is such that the scope of independent claims 1 and 2 is broader than justified by the description and the drawings (PCT Guidelines III-6.1), which refer exclusively to a method comprising the above-mentioned essential features in order to solve the technical problem posed, other possibilities not being contemplated in the application.

Thus, since the entire contents of the application convey the impression that the function of the claimed method is to be carried out in that particular way (PCT Guidelines III-6.5), claims 1 and 3 should have been reformulated in order to include all features essential to the definition of the invention.

telecommunications system such that upon detection of the Training code the Channelisation code is known.

According to the present invention there is provided a method of communicating, in an uplink mode, in a mobile communication system comprising a base station and a mobile terminal, the method comprising the steps of: selecting a Channelisation code ( $S_{k,Q}$ ), at random, from a plurality of Channelisation codes; selecting a Training code ( $m_j$ ); encoding a data according to the Channelisation code, with a spreading factor (Q) dependent upon the selected Channelisation code; transmitting the Training code with the data; detecting the Training code and the data; applying a set of rules to the training code and spreading factor whereby to determine the Channelisation code, and; decoding the data.

According to another aspect of the present invention, there is provided a method of communicating, in a downlink mode, in a mobile communication system comprising a base station and a mobile terminal, the method comprising the steps of: selecting a Channelisation code ( $S_{k,Q}$ ), selecting a Training code ( $m_j$ ) in accordance with a predetermined assignment sequence; encoding data according to the Channelisation code, with a spreading factor (Q) dependent upon the predetermined assignment sequence; transmitting the Training code with the data; detecting the training code and the data; determining the training code sequence by the mobile terminal, and; applying a set of rules to the Training code and spreading factor whereby to determine the Channelisation code, and; decoding the data.

The method according to the present invention may be used in a Code-Division Multiple Access mobile telecommunication system.

Alternatively, the method may be used in a Code-Time Division Multiple Access mobile telecommunications system.

Alternatively, the method may be used in a time division duplex mobile telecommunication system.

Alternatively, the method may be used in a UMTS mobile telecommunications system.

Advantageously, the present invention eliminates the need for explicit transmission of the Training code during uplink mode of operation of a mobile telecommunications system with dedicated channels.

Furthermore, in systems with non-dedicated channels where the mobile terminal selects the Channelisation code at random, the association of the Training code and the Channelisation code is fixed, thus making the detection of data possible.

Advantageously, the present invention improves the performance of a mobile telecommunications system by insuring that the receiver knows the number of Channelisation codes active in a given time slot.

While the principle advantages and features of the invention have been described above, a greater understanding and appreciation of the invention may be obtained by referring to the drawings and detailed

**CLAIMS**

1. A method of communicating, in an uplink mode, in a mobile communication system comprising a base station ad a mobile terminal, the method comprising the steps of:

selecting a Channelisation code ( $S_{k,Q}$ ), at random, from a plurality of available Channelisation codes;

selecting a Training code ( $m_j$ );

encoding data according to the Channelisation code, with a spreading factor (Q) dependent upon the selected Channelisation code;

transmitting the Training code with the data;

detecting the Training code and the data;

applying a set of rules to the Training code and spreading factor whereby to determine the Channelisation code, and;

decoding the data.

2. A method as claimed in Claim 1, wherein the spreading factor of the randomly selected Channelisation code is 16.

3. A method of communicating, in a downlink mode, in a mobile communication system comprising a base station and a mobile terminal, the method comprising the steps of:

selecting a Channelisation code( $S_{k,Q}$ );

selecting a Training code ( $m_j$ ) in accordance with a predetermined assignment sequence;

encoding data according to the Channelisation code, with a spreading factor (Q) dependent upon the predetermined assignment sequence;

transmitting the Training code with the data;  
detecting the Training code and the data;  
determining the training code sequence by the mobile terminal, and;  
applying a set of rules to the Training code and spreading factor whereby  
to determine the Channelisation code, and;  
decoding the data.

4. A method as claimed in Claim 3, wherein the predetermined assignment  
sequence is:

for  $Q = 16$ :  $\{m_1, m_0, m_5, m_4, m_3, m_2, m_7, m_6\}$

for  $Q = 8$ :  $\{m_6, m_2, m_4, m_0\}$

for  $Q = 4$ :  $\{m_2, m_0\}$

for  $Q = 2$ :  $\{m_0\}$

where  $Q$  equals the spreading factor and  $m_j$  represents the available  
Training codes.

5. A Code-Division Multiple Access mobile telecommunication system  
operable in accordance with the methods as claimed in any of Claims 1 - 4.

6. A Code-Time Division Multiple Access mobile telecommunications  
system operable in accordance with the methods as claimed in any of Claims 1 -  
4.

7. A time division duplex mobile telecommunication system operable in  
accordance with the methods as claimed in any of Claims 1 - 4.

8. A UMTS mobile telecommunications system operable in accordance with the methods as claimed in any of Claims 1 - 5.
9. A mobile terminal operable in accordance with any one of Claims 1 - 4.
10. A base station operable in accordance with any one of Claims 1 - 4.

METHOD OF ASSOCIATING A TRAINING CODE TO A CHANNELISATION CODE IN A MOBILE TELECOMMUNICATION SYSTEM

The present invention relates to improvements in or relating to mobile telecommunication systems, and is more particularly concerned with such systems operating on code-time division multiple access.

The UMTS terrestrial radio access (UTRA) - time division duplex (TDD) system is based on a combination of code division multiple access (CDMA) and hybrid time division multiple access (TDMA) which is known in the art as code-time division multiple access (CTDMA). (UMTS is an acronym for universal mobile telecommunication system also known by persons skilled in the art.)

In time division multiple access (TDMA), the time axis is divided into a plurality of time slots and users are permitted to transmit in certain ones of those time slots. Code division multiple access (CDMA), on the other hand, utilises direct sequence spread spectrum (DSSS) where a data is multiplied by a spreading factor ( $Q$ ) prior to transmission in order to encode the data.

Current mobile telecommunications systems comprise a plurality of telecommunication cells each having at least one base station and at least one mobile terminal. Both the base station and the mobile terminal are capable of functioning as a transmitter and a receiver of radio frequency (RF) signals.

In a CTDMA system a number of users are permitted to transmit data sets during the same time slot. Each data set in a given time slot is separated by code division.

In order to receive transmissions in each time slot, the receiver must be able to estimate the characteristics of the transmission channel between the transmitter and receiver. In mobile telecommunications applications multipath distortion can arise and training sequences or some known data content is needed to facilitate channel estimation in the receiver. The information needed to estimate the transmission channel's characteristics is contained in the channel's impulse response, a term well known in the art. The training sequence may be referred to as a Training code, Midamble code, or Pilot code, all terms well known in the art. For the purposes of the following discussion of the prior art and disclosure of the present invention, the term Training code will be used when referring to the training sequence as defined above.

The Training code is required on both the uplink from mobile terminal to base station and the downlink from the base station to the mobile terminal in order that each transmission path to and from each user can be estimated.

A separate and distinct code from the Training code is the Channelisation code. The Channelisation codes are orthogonal codes taken from the set of Walsh codes and is a term well known in the art. The Channelisation code contains an index number and a spreading factor, both of which serve to encode the data prior to transmission. Thus the Channelisation code is also required during both uplink and downlink in order to interpret a user's data.

To enable multiple spreading factors to be applied to different user's data within the same time slot the Channelisation codes are assigned in a particular way. The preferred method of assigning Channelisation codes,

which is well known in the art, is the Orthogonal Variable Spreading Factor (OVSF) code relationship and is shown in the tree-link structure in Figure 1.

Currently during the downlink, a single Training code is transmitted along with all the data sets of the users in a given time slot. The receiver detects all these data sets along with the single Training code. This is known in the art as Joint Detection and it increases the probability of detecting the data set of interest to a particular mobile terminal user. Having received all the data sets the Receiver must know all the active Channelisation codes in order to insure it is able to interpret the data set of interest.

A problem with the current method is that if the receiver is configured to detect 8 Channelisation codes but only 2 data sets are active, the performance of system will be decreased. Similarly if the receiver is configured to detect 2 Channelisation codes but 6 data sets are active, the performance of the system will be decreased.

Currently, on the uplink of a dedicated channel the base station will know both the Channelisation code and the Training code as it assigns them. The base station communicates these to the mobile terminal in the prior downlink transmission.

However, on the uplink of channels that are not dedicated, for example when the mobile terminal is first switched on, there is often no signalling mechanism to assign Channelisation codes and the mobile terminal will pick at random a Channelisation code to transmit with. Under these circumstances a fixed relationship between the training and Channelisation code must be adopted.

It is therefore an object of the present invention to provide a method of associating a Training code to a Channelisation code in a mobile

telecommunications system such that upon detection of the Training code the Channelisation code is known.

According to the present invention there is provided a method of associating a Training code to a Channelisation code for use in a mobile telecommunication system comprising a base station and a mobile terminal, the method comprising the steps of selecting a Channelisation code, encoding data according to the Channelisation code, selecting a Training code based on a predetermined selection process, transmitting the Training code with the data, detecting the Training code and the data, and applying a set of rules to the Training code such that the Channelisation code is known, thereby facilitating interpretation of the data.

According to an aspect of the present invention, wherein the mobile telecommunications system is operating in an uplink mode, the steps include the mobile terminal selecting at random a Channelisation code from a plurality of available Channelisation codes, the predetermined selection process being such that the Training code selected for transmission to the base station is determined by the Channelisation code selected, and the set of rules applied to the Training code upon detection by the base station being such that for each Training code detected the Channelisation code used to encode the data received with that Training code is known.

According to a further aspect of the present invention, wherein the mobile telecommunications system is operating in a downlink mode, the steps include the base station assigning Training codes to users in a given time slot in a predetermined assignment sequence, the predetermined assignment sequence

having a spreading factor associated therewith, and the base station and the mobile terminal having knowledge of the predetermined assignment sequence and associated spreading factor such that upon detection of the Training code by the mobile terminal the Channelisation code used to encode the data is known.

The method according to the present invention may be used in a Code-Division Multiple Access mobile telecommunication system.

Alternatively, the method may be used in a Code-Time Division Multiple Access mobile telecommunications system.

Alternatively, the method may be used in a time division duplex mobile telecommunication system.

Alternatively, the method may be used in a UMTS mobile telecommunications system.

Advantageously, the present invention eliminates the need for explicit transmission of the Training code during uplink mode of operation of a mobile telecommunications system with dedicated channels.

Furthermore, in systems with non-dedicated channels where the mobile terminal selects the Channelisation code at random, the association of the Training code and the Channelisation code is fixed, thus making the detection of data possible.

Advantageously, the present invention improves the performance of a mobile telecommunications system by insuring that the receiver knows the number of Channelisation codes active in a given time slot.

While the principle advantages and features of the invention have been described above, a greater understanding and appreciation of the invention may be obtained by referring to the drawings and detailed

description of the preferred embodiment, presented by way of example only, in which;

Figure 1 is a diagram of the known Orthogonal Variable Spreading Factor Channelisation code relationship,

Figure 2 is a diagram, according to the present invention, of the association between Training code and Channelisation code for the Uplink Mode of Operation.

Figure 3 is a diagram, according to the present invention, of the association between Training code and Channelisation code for the Downlink Mode of Operation.

In Figure 1, a known method of depicting Channelisation codes of different spreading factors is shown in the tree-like structure (10). The available Channelisation codes are denoted by  $S_{k,Q}$ , where k is the index number and Q is the spreading factor. According to this known method, in order for a Channelisation code to be assigned no other codes of a higher or lower spreading factor along the same branch of the tree on which the code lies can already be assigned.

For example, if  $S_{0,4}$  is the code to be assigned, then  $S_{0,8}$ ,  $S_{1,8}$ ,  $S_{0,2}$ , and  $S_{0,1}$  cannot already be assigned.

As was previously stated, both the transmitter and receiver need to know which Training code and which Channelisation code to use. The complexity of the relationship between the Training code and the Channelisation code will depend on whether the telecommunication system is operating in an downlink mode (base station to mobile terminal) or uplink mode (mobile terminal to base station), and are thus the two modes of operation will be treated separately.

In Figure 2, the association, according to the present invention, between the Training code and the Channelisation code for the uplink mode of operation is showing in tree-like structure (20). As in Figure 1, the available Channelisation codes are denoted by  $S_{k,Q}$ , where k is the index number and Q is the spreading factor. The available Training codes are denoted by  $m_j$ , where j is an integer indicating the maximum number of Training codes available for use in a given time slot. As will be appreciated by those skilled in the art, a plurality of Training codes and a plurality of Channelisation codes may be available.

The association, according to the present invention, between Training codes and Channelisation codes in an uplink mode of operation as shown in Figure 2 will be explained with reference to the following example.

In a preferred embodiment of the present invention a single spreading factor is always used. In the following example of a preferred embodiment of the present invention a spreading factor of 16 is always used. As will be appreciated by those skilled in the art other spreading factors may be used without departing from the scope of the present invention. When a user first switches the mobile terminal on he is operating in an uplink mode on a non dedicated channel. The mobile terminal will select at random a Channelisation code with a spreading factor of 16 in which to use during the first transmission to the base station. Both the base station and the mobile terminal know the association of the codes as shown in Figure 2. Thus once a Channelisation code with a spreading factor of 16 has been randomly selected, the Training code must be the one associated with it as per Figure 2. For example, if the Channelisation code  $S_{6,16}$  has been selected, the Training code  $m_6$  must also be used. The data is encoded according to the

Channelisation code  $S_{6,16}$  and transmitted along with Training code  $m_6$ . The base station then operates to detect the data and the Training code. Upon determining which Training code has been used, the base station will be able to determine which Channelisation code to use based on the association of codes shown in Figure 2. The base station will then be able to interpret the data.

During the downlink mode of operation, the requirements for code association are slightly more complicated. If the mobile terminal is to perform Joint Detection then it needs to know which are the active Channelisation codes and which codes are not active. It is not desirable for this information to be broadcast to all users because of the overhead required. Instead if different Training codes are assigned to each Channelisation code, then a user can easily detect which are the active codes by correlation with the known Training code, rather than attempting to measure the power in all possible codes. However the multiple spreading factors mean that there is a many to one relationship between the Channelisation code and Training code. Adopting a one to one relationship requires the user to correlate with more Training codes. However, if the relationship as shown in Figure 3 is adopted, together with additional rules governing the assignment of Channelisation codes, then the mobile terminal can determine the ambiguity between the Training code and the Channelisation code.

In Figure 3, the association, according to a further aspect of the present invention, between Training codes and Channelisation codes for the downlink mode of operation is shown in tree-like structure (30). The notation used in Figure 3 is the same as used in Figures 1 and 2.

An assignment sequence is used in conjunction with the rules of the OVSF tree shown in Figure 1, such that for a Channelisation code to be used, no other code with a spreading factor greater or smaller than the Channelisation code to be assigned can also be assigned along the same branch of the tree. A preferred assignment sequence for the association between Training code and Channelisation code is given below:

$$Q = 16: \{m_1, m_0, m_5, m_4, m_3, m_2, m_7, m_6\}$$

$$Q = 8: \{m_6, m_2, m_4, m_0\}$$

$$Q = 4: \{m_2, m_0\}$$

$$Q = 2: \{m_0\}$$

As will be appreciated by those skilled in the art alternative assignment sequences may be used without departing from the scope of the present invention.

Assignments for a particular spreading factor are made from left to right in the above sequences. Consequently, if the first Channelisation code uses Training code  $m_1$  then subsequent use of Training code  $m_0$  means that it must be associated with a spreading factor of 16, until Training code  $m_1$  is relinquished. Similarly the use of Training code  $m_0$  before Training code  $m_1$  signifies that the spreading factor is 2. The assignment ordering above together with the rules of the OVSF tree means that Channelisation code can be determined, providing that the presence of the Training codes can be reliably detected.

The association, according to the present invention, between Training codes and Channelisation codes in an downlink mode of operation as shown in Figure 3 will be explained with reference to the following example.

After a user has switched on his mobile terminal and established contact with the base station, the base station will then assign that user a Channelisation code and a Training code. However, as will be appreciated by those skilled in the art, in a CDMA or CTDMA system, several users may be operating in the same time slot, all with their own unique Channelisation code and Training code as assigned by the base station. The base station will transmit simultaneously all the data of the users operating in that given time slot. According to an aspect of the present invention, the base station will only transmit a single Training code with each user's data. Furthermore, the base station will assign Training codes accordingly to the assignment sequence given above. Both the base station and the mobile terminal will know the association of the codes as shown in Figure 3 and the assignment sequence. The mobile terminal operating in Joint Detection will detect all the data and Training codes transmitted by the base station. Based on the order the Training codes are received, the mobile terminal will know which spreading factor has been used to encode the data. Knowing the Training code and the spreading factor allows the mobile terminal to determine the active Channelisation codes by reference to the association of codes shown in Figure 3.

For example, if the Training codes  $m_6$ ,  $m_2$ ,  $m_4$ , and  $m_0$  are detected by the mobile terminal, then based on the assignment sequence given above, the mobile terminal knows that the spreading factor is 8. Now by referring to association of codes shown in Figure 3, the mobile terminal will known that

the Channelisation code  $S_{3,8}$ ,  $S_{2,8}$ ,  $S_{1,8}$ , and  $S_{0,8}$  are active in the time slot and thus be looking for 4 sets of data.

As is well known in the art the Training code is easier to detect because it has a fixed sequence.

As was previously stated, the performance for the system is enhanced when the receiver knows which Channelisation codes are active in a given time slot. The present invention provides a method for doing this.

As will be appreciated by those skilled in the art, the method of associating codes as per the present invention, can be used in a mobile telecommunication system operating in CDMA or CTDMA.

Furthermore, the method according to the present invention can be used in UMTS.

As will be appreciated by those skilled in the art, various modifications may be made to the embodiment hereinbefore described without departing from the scope of the present invention.

**CLAIMS**

1. A method of associating a Training code to a Channelisation code for use in a mobile telecommunication system comprising a base station and a mobile terminal, the method comprising the steps of:

selecting a Channelisation code,  
encoding data according to the Channelisation code,  
selecting a Training code based on a predetermined selection process,  
transmitting the Training code with the data,  
detecting the Training code and the data, and  
applying a set of rules to the Training code such that the

Channelisation code is known, thereby facilitating interpretation of the data.

2. A method as claimed in Claim 1, wherein the mobile telecommunications system is operating in an uplink mode, and the steps include:

the mobile terminal selecting at random a Channelisation code from a plurality of available Channelisation codes,

the predetermined selection process being such that the Training code selected for transmission to the base station is determined by the Channelisation code selected, and

the set of rules applied to the Training code upon detection by the base station being such that for each Training code detected the Channelisation code used to encode the data received with that Training code is known.

3. A method as claimed in Claim 2, wherein the spreading factor of the randomly selected Channelisation code is 16.

4. A method as claimed in any preceding Claim, wherein the mobile telecommunications system is operating in a downlink mode, and the steps include:

the base station assigning Training codes to users in a given time slot in a predetermined assignment sequence, the predetermined assignment sequence having a spreading factor associated therewith, and

the base station and the mobile terminal having knowledge of the predetermined assignment sequence and associated spreading factor such that upon detection of the Training code by the mobile terminal the Channelisation code used to encode the data is known.

5. A method as claimed in Claim 4, wherein the predetermined assignment sequence is:

for  $Q = 16$ :  $\{m_1, m_0, m_5, m_4, m_3, m_2, m_7, m_6\}$

for  $Q = 8$ :  $\{m_6, m_2, m_4, m_0\}$

for  $Q = 4$ :  $\{m_2, m_0\}$

for  $Q = 2$ :  $\{m_0\}$

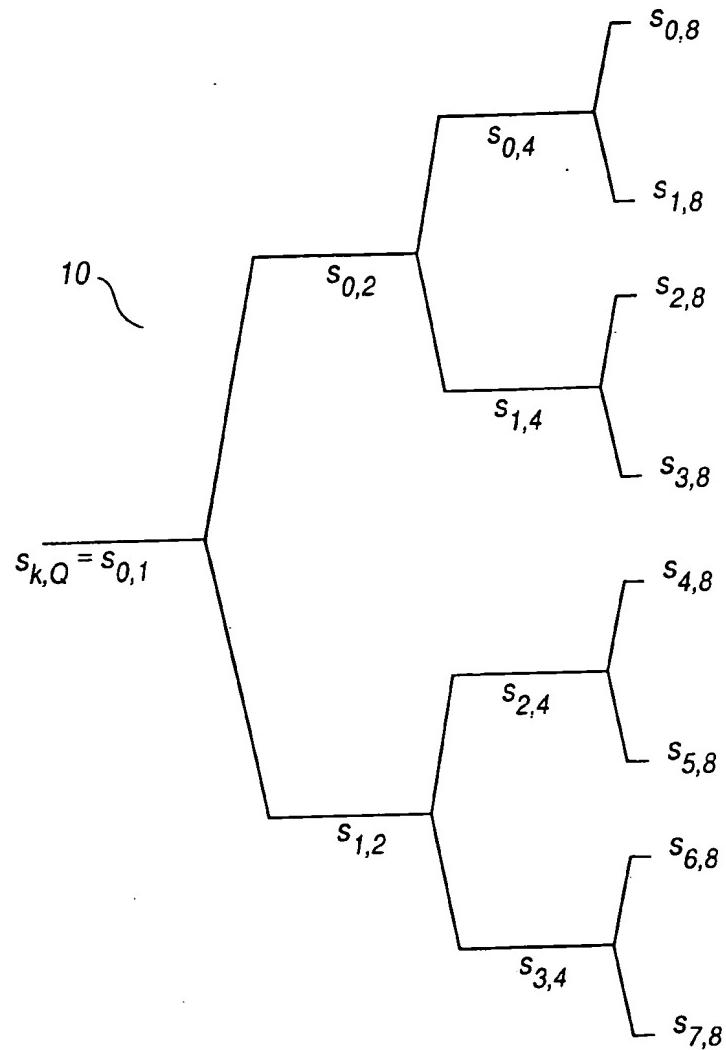
where  $Q$  equals the spreading factor and  $m_i$  represents the available Training codes.

6. A Code-Division Multiple Access mobile telecommunication system using the method as claimed in any of Claims 1 - 5.

7. A Code-Time Division Multiple Access mobile telecommunications system using the method as claimed in any of Claims 1 - 5.

8. A time division duplex mobile telecommunication system using the method as claimed in any of Claims 1 - 5.
9. A UMTS mobile telecommunications system using the method as claimed in any of Claims 1 - 5.
10. A method of associating a Training code to a Channelisation code as hereinbefore described with reference to the accompanying drawings.

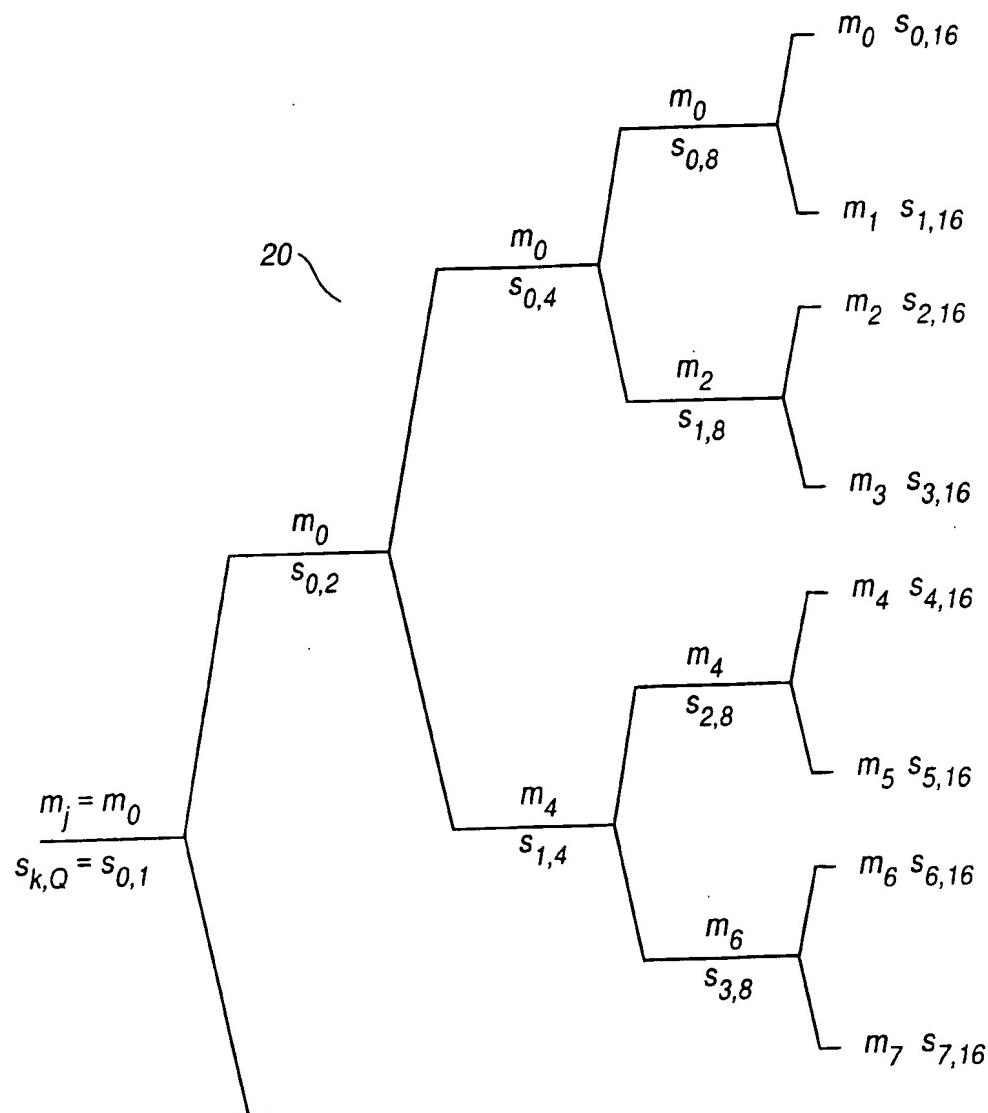
1/3



*Orthogonal Variable Spreading Factor Channelisation Codes Relationship*

*Fig 1*

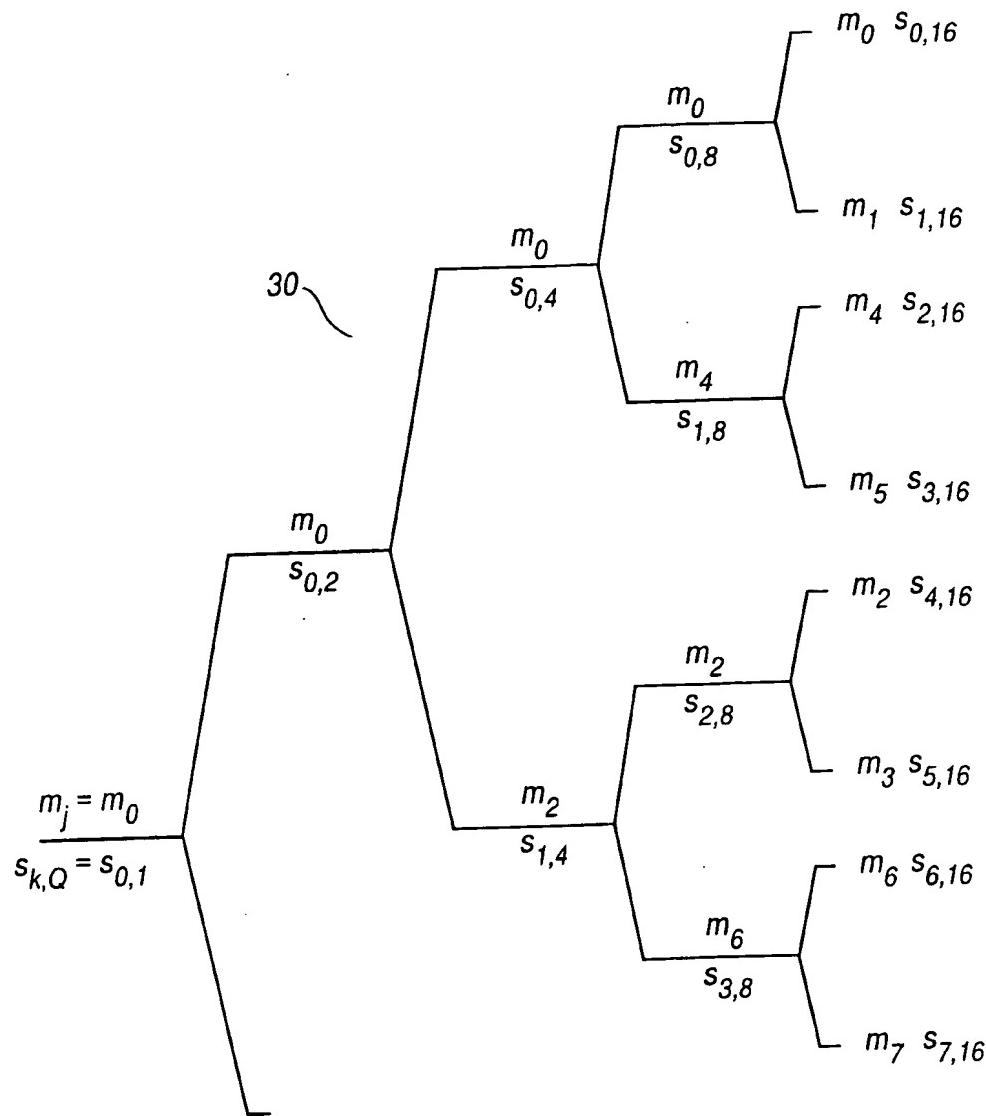
2/3



Association Between Training Code and Channelisation Code for the Uplink

Fig 2

3/3



*Association Between Training Code and Channelisation Code for the Downlink*

*Fig 3*

# INTERNATIONAL SEARCH REPORT

Intel. Application No  
PCT/GB 00/02394

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 H04J11/00 H04L25/02 H04B7/26

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 H04J H04L H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data, INSPEC

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99 03224 A (OVESJÖ F ET AL (SE); TELEFONAKTIEBOLAGET LM ERICSSON (SE)) 21 January 1999 (1999-01-21) page 4, line 6 -page 5, line 2 page 5, line 23 -page 6, line 9 page 6, line 28 -page 10, line 11 claims 8,9,16,17	1,6-9
X	---	10
A	WO 99 08401 A (BAHRENBURG STEFAN ET AL (DE); SIEMENS AKTIENGESELLSCHAFT (DE)) 18 February 1999 (1999-02-18) abstract page 6, line 9 -page 15, line 17	1,6-9
X	-----	10

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

\* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*&\* document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

29 September 2000

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Name and mailing address of the ISA  
 European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax: (+31-70) 340-3016

Authorized officer

Chauvet, C

## INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte... ial Application No

PCT/GB 00/02394

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9903224	A 21-01-1999	US 6108369 A		22-08-2000
		AU 8364098 A		08-02-1999
		EP 0995284 A		26-04-2000
		ZA 9805930 A		27-01-1999
WO 9908401	A 18-02-1999	AU 9337198 A		01-03-1999
		EP 1004172 A		31-05-2000

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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International Bureau



(43) International Publication Date  
4 January 2001 (04.01.2001)

PCT

(10) International Publication Number  
WO 01/01618 A1

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(25) Filing Language: English

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Published:  
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(30) Priority Data:

9914858.7 25 June 1999 (25.06.1999) GB

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

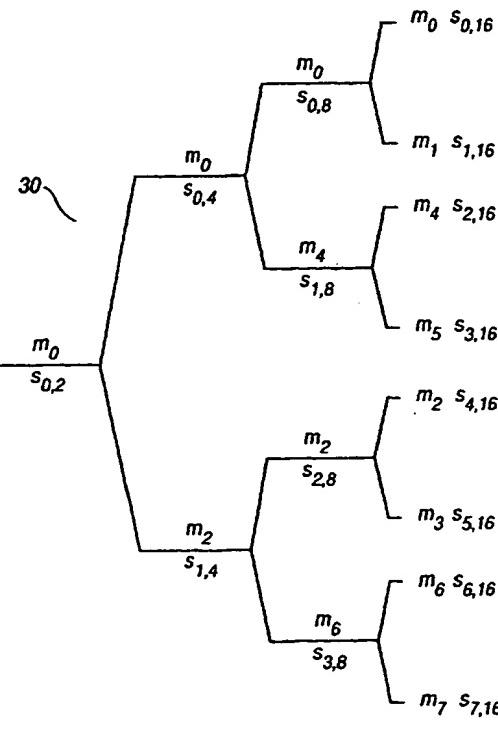
(71) Applicant (for all designated States except US): ROKE

MANOR RESEARCH LIMITED [GB/GB]; Roke Manor, Old Salisbury Lane, Romsey, Hampshire SO51 0ZN (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): WALES, Stephen,

(54) Title: METHOD OF ASSOCIATING A TRAINING CODE TO A CHANNELISATION CODE IN A MOBILE TELECOMMUNICATION SYSTEM



(57) Abstract: A method of associating the Training code to a Channelisation code in a mobile telecommunications system. The method includes associating a Training code with a Channelisation code prior to transmission according to a set of rules such that upon detection of the Training code by a receiver, the Channelisation code is known.

WO 01/01618 A1

Association Between Training Code and Channelisation Code for the Downlink

## PATENT COOPERATION TREATY

PCT

REC'D 27 SEP 2000

WIPO PCT

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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>P79844WO</b>	<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. <b>PCT/GB99/02394</b>	International filing date (day/month/year) <b>23/07/1999</b>	Priority date (day/month/year) <b>23/07/1998</b>
International Patent Classification (IPC) or national classification and IPC <b>A01N47/22</b>		
Applicant <b>UNIVERSITY COLLEGE CARDIFF CONSULTANTS LTD ET AL.</b>		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 9 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 1 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the report</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input checked="" type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input checked="" type="checkbox"/> Certain documents cited</li> <li>VII <input checked="" type="checkbox"/> Certain defects in the international application</li> <li>VIII <input checked="" type="checkbox"/> Certain observations on the international application</li> </ul>		

Date of submission of the demand <b>18/02/2000</b>	Date of completion of this report <b>25.09.00</b>
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer <b>Elliott, A</b> Telephone No. +49 89 2399 8218



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB99/02394

**I. Basis of the report**

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

**Description, pages:**

1-12                   as originally filed

**Claims, No.:**

5-24                   as originally filed

1-4                   as received on                   11/09/2000   with letter of                   11/09/2000

**Drawings, sheets:**

1/3-3/3               as originally filed

2. The amendments have resulted in the cancellation of:

- the description,      pages:  
 the claims,               Nos.:  
 the drawings,           sheets:

3.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**IV. Lack of unity of invention**

1. In response to the invitation to restrict or pay additional fees the applicant has:

- restricted the claims.  
 paid additional fees.  
 paid additional fees under protest.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB99/02394

- neither restricted nor paid additional fees.
2.  This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- complied with.
- not complied with for the following reasons:
- see separate sheet**
4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:
- all parts.
- the parts relating to claims Nos. .

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims 3-12, 14
	No:	Claims 1, 2, 13, 15-24
Inventive step (IS)	Yes:	Claims -
	No:	Claims 1-24
Industrial applicability (IA)	Yes:	Claims 1-24
	No:	Claims -

**2. Citations and explanations**

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB99/02394

**VI. Certain documents cited**

1. Certain published documents (Rule 70.10)

and / or

2. Non-written disclosures (Rule 70.9)

**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/02394

The application is directed towards molluscicidal compositions comprising at least one molluscicide for target molluscs and at least one deterrent for non-target invertebrates. The repellent is selected from bicyclic compounds as given in claim 4, a monohydric C<sub>6-10</sub> alcohol, a compound of formula (VI) or (VII) as given in claim 7, benzene or cyclohexene derivative as given in claim 10, or non-volatile compound as given in claims 13 and 14.

Reference is made to the following documents:

- D1: DE 41 11 389 A (BAYER AG) 15 October 1992
- D2: R.WEGLER: 'Chemie der Pflanzenschutz- und Schädlingsbekämpfungsmittel, Band 1' 1970 , SPRINGER , BERLIN, DE XP002121255
- D3: DE 40 12 224 A (HOLTMANN HEINRICH DR) 17 October 1991
- D4: DATABASE WPI AN 1993-348296 (abstract of JP 05 255007 A (TUFTY GMBH) 5 October 1993)
- D5: WO 98 51150 A (BOWEN IVOR ;SANGOSSE UK S A DE (GB)) 19 November 1998
- D6: DATABASE WPI AN 1983-08680K (abstract of JP 57 203003 A (HOKKO CHEM IND CO LTD) 13 December 1982)
- D7: DATABASE WPI AN 1981-24453D (abstract of JP 56 015203 A (EARTH SEIYAKU KK) 14 February 1981)
- D8: ASPECTS OF APPLIED BIOLOGY, no. 31, 1992, pages 87-96, L.SAMSOE-PETERSEN ET AL.: 'Interpretation of laboratory measured effects of slug pellets on soil dwelling invertebrates'
- D9: Z.ANGEW.ZOOL., vol. 77, no. 3-4, 1991, pages 479-500, W.BUECHS ET AL.: 'Studies on the Effect of Molluscicides on Some Carabid Beetles (Coleoptera: Carabidae) by Application in Different Laboratory and Semi-Field Tests'

**IV Lack of unity of invention**

The object of the present application was to provide molluscicide compositions which avoided the problem of non-target organisms also being affected by the molluscicides, e.g. in pellet form. The solution as proposed by the present application is to provide the molluscicide in the form of a composition comprising a molluscicidal compound and a repellent for the non-target organisms. This solution is already known in the prior art, cf. in particular document D1 but also documents D6 and D7 (cf. under point V below, D1 being considered novelty-destroying and D6 and D7 being considered to make the presently-claimed subject-matter obvious by way of the fact that they mention the possibility of the molluscicides being combined with repellents). As a result the particular solutions as proposed in the present application (bicyclic compounds as given in claim 4, a monohydric C<sub>6-10</sub> alcohol, a compound of

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/02394

formula (VI) or (VII) as given in claim 7, benzene or cyclohexene derivative as given in claim 10, or non-volatile compound as given in claims 13 and 14) are not seen to have a common functional technical feature, i.e. common structural feature, in the sense of Rule 13.2 PCT that could unify the subject-matter of the application.

The International Examination Authority therefore sees the application to contain the following separate inventions:

1. Claims 1, 2, 15-24 (partially), 3-6 (completely) directed to compositions containing molluscicide and repellent where the repellent is a bicyclic compound.
2. Claims 1, 2, 7, 9, 15-24 (all partially) directed to compositions containing molluscicide and repellent where the repellent is a monohydric or polyhydric C<sub>6</sub>-10 alcohol.
3. Claims 1, 2, 7, 9, 15-24 (all partially) directed to compositions containing molluscicide and repellent where the repellent is a compound according to formula (VI).
4. Claims 1, 2, 7, 8, 9, 15-24 (all partially) directed to compositions containing molluscicide and repellent where the repellent is a compound according to formula (VII).
5. Claims 1, 2, 10, 11, 12, 15-24 (all partially) directed to compositions containing molluscicide and repellent where the repellent is a substituted 6-membered carbocyclic ring where the carbocyclic ring is benzene.
6. Claims 1, 2, 10, 11, 12, 15-24 (all partially) directed to compositions containing molluscicide and repellent where the repellent is a substituted 6-membered carbocyclic ring where the carbocyclic ring is cyclohexene.
7. Claims 1, 2, 15-24 (partially), 13, 14 (completely) directed to compositions containing molluscicide and repellent where the repellent is a non-volatile compound/a tetrano-terpenoid.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/02394

**V Reasoned statement under Art 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

D1 discloses the use of Imidacloprid (1-(2-chloro-5-pyridinylmethyl)-2-nitroiminoimidazolidine) as a carabid beetle repellent in molluscicide formulations, especially slug/snail baits. Mercaptodimethur, otherwise known as methiocarb, is the preferred molluscicide used in D1. D1 also addresses and exemplifies possible food/bait material and carrier material for the molluscicide and repellent. A pelletised form is produced in the examples. The subject-matter of present claims 1, 2, 13, 15-24 is not novel with respect to D1. (The applicant has argued that Imidacloprid is in fact an insecticide. The fact remains that D1 discloses the use of Imidacloprid as a repellent and therefore the fact that it's normal use is as an insecticide is irrelevant. The amendments made to claim 1 further do not distinguish the composition claimed in the present application from that of D1.)

D2 addresses insect repellents. There is no mention of combining the insect repellents in D2 into molluscicide formulations. Novelty can be acknowledged with respect to D2. However, it would be considered obvious for the skilled person to include known insect repellents into molluscicide formulations to solve the problem of insects ingesting or coming into contact with molluscicide formulations. Compounds falling under the scope of the repellents of claims 3-12 and 14 are to be found in D2. The combination therefore of the teachings of D2 with D1 leads to the subject-matter of claims 1-24 being obvious.

D3 discloses an agent and method for controlling apian behaviour using a repellent. The repellent is selected from (cf. claim 1) organic compounds with at least one hydroxy group, phenolic compounds, aldehydes, ketones, carboxylic acids, carboxylic acid esters and derivatives, ethers, sulphur compounds, alkanes, benzene and benzene derivatives, chlorinated hydrocarbons, organic nitrogen compounds, terpenes and fatty acids. An extensive list of exemplary compounds is to be found in claim 7. Again the skilled person would find in D3 a solution to the problem of stopping non-target insects from coming into contact with molluscicide compositions by incorporating the insect repellents from D3 into known molluscicide compositions. The subject-matter of claims 1-24 is seen to be obvious by means of combining the teachings of D3 with D1.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/02394

D4 discloses non-toxic repellents for ants and termites containing a natural or synthetic borneol, isoborneol, eucalyptus oil, eucalyptol, clove oil, eugenol or indole and optionally natural or synthetic isopropanol, lemon oil, bitter orange oil, citral, citronellal or etheric citrus oil. As with D3 and D2 above, the skilled person would find a solution to the problem of non-target insects coming into contact with molluscicide formulations in D4 by combining the repellents of D4 with known molluscicide compositions. Claims **1-24** are therefore obvious.

D6 discloses an anti slug and snail agent containing one or more fatty alcohols as the active component. The agent may be combined with a repellent. From D6's disclosure alone, it would therefore appear that the subject-matter of claims **1** and **19-24** is obvious. Furthermore, it would also appear that the skilled person would combine the repellents of D2-D4 with the teachings of D6 to come up with compositions rendering the subject-matter of claims **1, 3-14, 19-24** obvious.

D7 is directed towards gastropod controlling agents containing as the active component diethyltoluamide. The agent may be used with known insect repellents. From D7's disclosure alone the subject-matter of claims **1** and **19-24** becomes obvious. Again the skilled person would combine the insect repellents of documents D2-D4 with the teaching of D7 to come up with compositions rendering claims **1, 3-14, 17-24** obvious.

D8 relates to the survival of non-target invertebrates who are subjected to environments containing the molluscicides metaldehyde and methiocarb. From D8 it is obvious that the problem of non-target invertebrate attraction to/poisoning by molluscicides was known. It would also appear obvious that a means of stopping this attraction/poisoning would be to repel the non-target organisms away from the molluscicides by using a combination of molluscicide and repellent (e.g. from D2-D4). The subject-matter of claims **1-24** is therefore rendered obvious by D8 in combination with the insect repellents of D2-D4.

D9, similarly to D8, discloses data concerning the toxicity of metaldehyde- and methiocarb-containing molluscicidal compositions for carabid beetles (as well as mentioning previously known toxicity cases concerning earthworms and other non-target organisms. Again from D9's disclosure it would appear obvious for the skilled

person to try and find away of solving the problem of non-target organisms being the victim of molluscicidal compositions. And again the solution of repelling these non-target organisms away from the molluscicidal compositions by using repellents (cf. D2-D4) would be an obvious way for the skilled person to achieve this. The subject-matter of claims 1-24 is again rendered obvious.

The combination of molluscicide and repellent as indicated above as being non-inventive is made all the more non-inventive by the fact that compositions of this type are already known from D1 (the object of the present application therefore being seen as the provision of alternative compositions) and clearly suggested by documents D6 and D7.

**VI Certain documents cited**

D5, published on 19 November 1998, i.e. in the priority interval of the present application, is not to be considered as prior art according to Rule 64.3 PCT.

It is, however, already pointed out that the content of D5 may be taken into account in the examination of the patentability of the presently-claimed subject-matter of the present application when the application enters the regional phase of the proceedings depending upon the validity of the priority claimed for the present application and that claimed for D5.

D5 discloses a molluscicide containing a non-toxic animal repellent and metaldehyde.

**VII Certain defects in the international application**

Contrary to the requirements of Rule 5.1(a)(ii) PCT, neither has the relevant background art disclosed in documents D1-D9 been mentioned in the description, nor have these documents been identified therein.

**VIII Certain observations on the international application**

The term "non-volatile compound" used in claim 13 is such that the subject-matter of this claim has no clearly-defined scope.

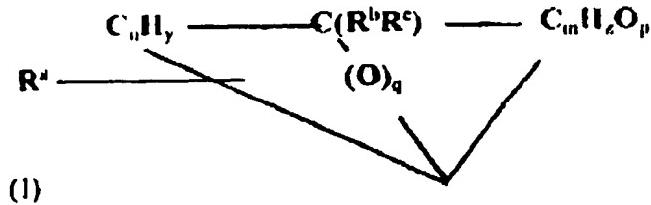
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**Claims**

1. A molluscicidal composition comprising at least one molluscicide for target molluses, and at least one deterrent for non-target invertebrates, wherein said deterrent is substantially repellent to the non-target invertebrates and substantially palatable to the target molluses, said deterrent being incorporated in the composition so as to have the following results:
  - a) it has substantially no effect on target molluses feeding on the composition;
  - b) it precludes feeding on the composition by the non-target invertebrates; and
  - c) it elicits avoidance behaviour in the non-target invertebrates.
2. A molluscicidal composition according to claim 1, wherein said molluscicide is methiocarb.
3. A molluscicidal composition according to claim 1 or 2, wherein said deterrent comprises a bicyclic compound.
4. A molluscicidal composition according to claim 3, wherein said bicyclic compound is of the following general formula (I).



where n is 2 to 4, y is 2n or 2n-2, m is 0 to 3, z is 2m if p is 0 or 1, or z is m if p is 1, and q is 0 or 1; R<sup>a</sup>, R<sup>b</sup> and R<sup>c</sup> each independently represent hydrogen or C<sub>1-4</sub> alkyl; and where the oxygen in the C<sub>m</sub>H<sub>z</sub>O<sub>p</sub> group may be in a carbonyl group or a hydroxyl group, with appropriate values for m and z..

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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/GB99/02394  (22) International Filing Date: 23 July 1999 (23.07.99)  (30) Priority Data: 9816039.3 23 July 1998 (23.07.98) GB		(74) Agent: AUSTIN, Hedley, William; Urquhart-Dykes & Lord, Alexandra House, Alexandra Road, Swansea SA1 5ED (GB).	
(71) Applicants (for all designated States except US): UNIVERSITY COLLEGE CARDIFF CONSULTANTS LIMITED [GB/GB]; 55 Park Place, P.O. Box 923, Cardiff CF10 3AT (GB). INSECT INVESTIGATIONS LIMITED [GB/GB]; School of Pure & Applied Biology, University of Wales, P.O. Box 915, Cardiff CF1 3TL (GB).  (72) Inventor; and (75) Inventor/Applicant (for US only): SYMONSON, William, Oliver, Christian [GB/GB]; Gallt Hyfryd, Pontfadog, Llan-gollen, Clwyd LL20 7AG (GB).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
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<p><b>(54) Title:</b> MOLLUSCICIDAL COMPOSITION</p> <p><b>(57) Abstract</b></p> <p>The composition comprises at least one molluscicide for target molluscs, and at least one deterrent for non-target invertebrates, wherein the deterrent is incorporated in the composition so as to have substantially no effect on target molluscs feeding on the composition and to substantially preclude feeding on the composition by the non-target organisms. Examples of possible deterrents include bicyclic compounds, monohydric or polyhydric C<sub>6</sub>-10 alcohol, and a substituted 6-membered carbocyclic ring.</p>			

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Molluscicidal Composition

The present invention is concerned with a molluscicidal composition, a process of preparing the composition and the use thereof.

Slugs and snails are major pests in arable crops; particularly the field slug *Deroceras reticulatum*, with its ability to hollow grain and destroy newly emerged shoots and leaves. Current control measures rely primarily on the use of baited pellets containing a molluscicide, such as methiocarb. Although such pellets have been effective due to the toxicity of molluscicides, such as methiocarb, the latter has also been implicated in the poisoning of non-target organisms. This has been particularly problematic where the non-target organisms are themselves involved in pest control. For example, non-target insects, such as carabid beetles, which are known to be important natural control agents for several crop pests (including slugs), have been known to have died following ingestion of such methiocarb-containing pellets.

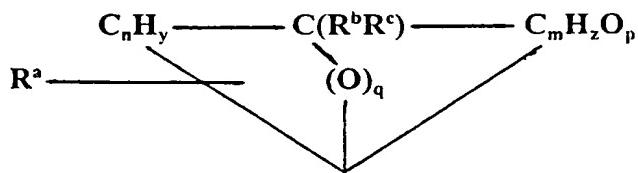
There does, therefore, exist a need for improved, more specific molluscicidal compositions palatable only to molluscs, and the present invention provides such improved compositions, processes of preparation and uses thereof.

According to the present invention there is provided a molluscicidal composition comprising at least one molluscicide for target molluscs, and at least one deterrent for non-target invertebrates, wherein the deterrent is incorporated in the composition so as to have substantially no effect on target molluscs feeding on the composition and to substantially preclude feeding on the composition by the non-target organisms.

The term "molluscicide" as used herein denotes an agent for destroying molluscs, and typically a composition according to the present invention is employed in destroying slugs, such as slugs of the species *Deroceras reticulatum*. Suitable molluscicides for use in the present invention include methiocarb or thiodicarb, although other available molluscicides can be used. Preferably, methiocarb is employed as a molluscicide in the present invention.

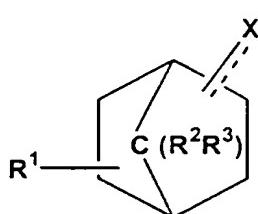
The term "deterrent" as used herein typically denotes a substance that can elicit avoidance behaviour in the non-target invertebrates, through detection of volatile or non-volatile chemicals via receptors on antennae, palps or other mouthparts of the non-target invertebrates. The deterrent employed in the present invention is selected so as to have substantially no effect on feeding molluscs, in other words mollusc feeding is substantially uninhibited by the inclusion of the deterrent in the composition. In this way, the present invention provides a molluscicidal composition that is unpalatable to the non-target invertebrates, but palatable to the target molluscs, and as such is substantially specific for the target molluscs. The non-target invertebrates are preferably insects (such as carabids).

According to a first aspect of the present invention, the deterrent comprises a bicyclic compound. Suitable bicyclic compounds can be represented by general formula (I)

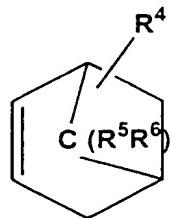


where n is 2 to 4, y is 2n or 2n-2, m is 0 to 3, z is 2m if p is 0 or 1, or z is m if p is 1, and q is 0 or 1; R<sup>a</sup>, R<sup>b</sup> and R<sup>c</sup> each independently represent hydrogen or C<sub>1-4</sub> alkyl. The oxygen in the C<sub>m</sub>H<sub>z</sub>O<sub>p</sub> group may be in a carbonyl group or a hydroxyl group, with appropriate values for m and z.

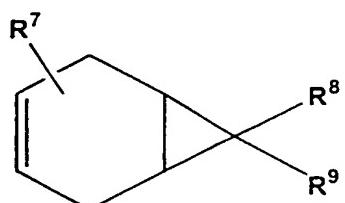
Preferred bicyclic compounds for use as a deterrent can be represented by any of formulae (II), (III), (IV) or (V)



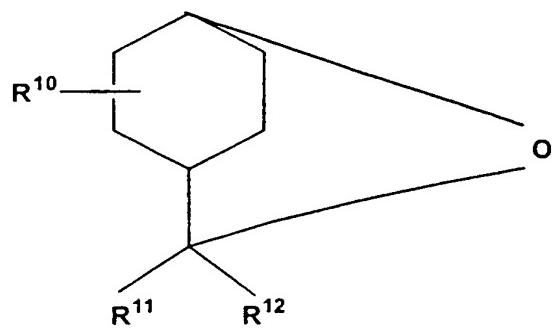
(II)



(III)



(IV)

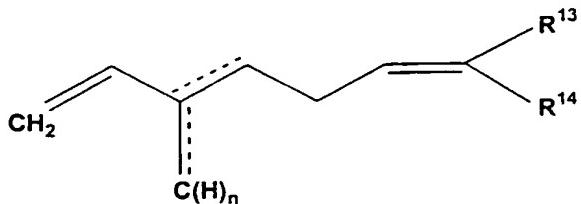


(V)

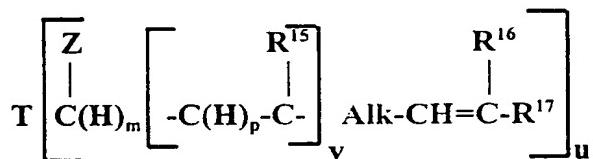
where R¹, R², R³, R⁴ R⁵, R⁶, R⁷, R⁸, R⁹, R¹⁰, R¹¹ and R¹² each independently represent hydrogen or C₁-alkyl, X represents oxygen or hydroxy and ----- represents a bond in the case where X represents oxygen.

Preferred compounds for use as a deterrent according to the first aspect of the present invention include camphor (1,7,7-trimethylbicyclo[2.2.1]heptan-2-one), borneol (*endo*-1,7,7-trimethylbicyclo[2.2.1]heptan-2-ol), eucalyptol (1,3,3-trimethyl-2-oxabicyclo[2.2.2]octane),  $\alpha$ -pinene (2,6,6-trimethylbicyclo[3.1.1]hept-2-ene), D-3-carene (3,7,7-trimethylbicyclo[4.1.0]hept-3-ene) or the like.

According to a second aspect of the present invention, the deterrent comprises a monohydric or polyhydric C<sub>6-10</sub> alcohol or a compound of formula (VI) or (VII)



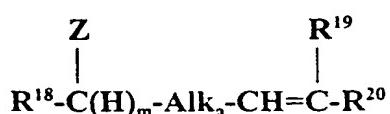
(VI)



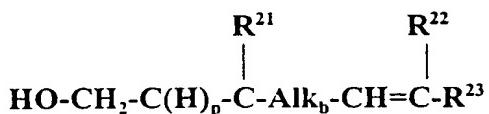
(VII)

where R<sup>13</sup>, R<sup>14</sup>, R<sup>15</sup>, R<sup>16</sup>, and R<sup>17</sup>, each independently represent C<sub>1-3</sub> alkyl, T is hydrogen or an aliphatic hydrocarbon group, Alk is a C<sub>1-3</sub> alkylene chain, Z is oxygen or hydroxy, n is 2 or 3, m is 0 or 1, v is 1 when T is hydrogen or 0 in all other cases, u is 1 or 2, p is 1 or 2 and ----- represents the optional presence of a bond.

Preferred compounds of formula (VII) for use as a deterrent can be represented by formulae (VIII) and (IX)



(VIII)



(IX)

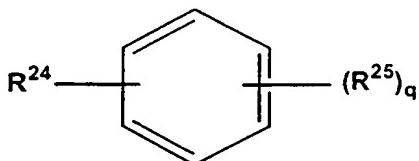
where R<sup>18</sup>, R<sup>19</sup>, R<sup>20</sup>, R<sup>21</sup>, R<sup>22</sup>, and R<sup>23</sup> each independently represent C<sub>1-3</sub> alkyl, Alk<sub>a</sub> and Alk<sub>b</sub> independently represent a C<sub>1-3</sub> alkylene chain, Z is oxygen or hydroxy, m is 0 or 1, and p is 1 or 2.

Preferred deterrents for use according to the second aspect of the present invention include one or more of 2-ethylhexane-1,3-diol, citronellol (3,7-dimethyl-6-octen-1-ol), octan-1-ol,  $\beta$ -myrcene (7-methyl-3-methylene-octa-1,6-diene), nerol (*cis*-3,7-dimethyl-octa-2,6-dien-1-ol),  $\beta$ -ocimene (3,7-dimethyl-octa-1,3,6-triene), sulcatol (6-methyl-5-hepten-2-ol), sulcatone (6-methyl-5-hepten-2-one) and lycopene or a material containing lycopene. More particularly, sulcatol, sulcatone and lycopene are especially preferred deterrents for use according to the second aspect of the present invention.

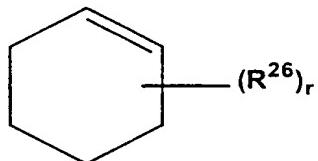
Lycopene is a precursor of sulcatone and is typically found in tomato skins. Lycopene may be advantageous in that only small amounts are lost during heat treatment, for example, 20% loss of lycopene when it is heated to 65 - 100 °C for 3 hours. Heat treatment may be used during production of molluscicidal compositions according to the invention, particularly when the latter are in the form of pellets.

According to a third aspect of the present invention, the deterrent comprises a substituted 6-membered carbocyclic ring, where the ring is either benzene or cyclohexene, and where the substituents are one or more of  $C_{1-4}$  alkyl,  $C_{2-4}$  alkenyl,  $C_{1-4}$  alkoxy, hydroxy,  $CO_2C_{1-4}$  alkyl,  $CON(C_{1-4} \text{ alkyl})_2$  and  $C_{1-4}$  alkylene $CON(C_{1-4} \text{ alkyl})_2$ .

Suitably, the third aspect of the present invention employs deterrents of formulae (X) or (XI)



(X)



(XI)

where  $R^{24}$  represents hydrogen,  $C_{1-4}$  alkyl or  $C_{2-4}$  alkenyl,  $R^{25}$  represents  $C_{1-4}$  alkyl,  $C_{1-4}$  alkoxy, hydroxy,  $CO_2C_{1-4}$  alkyl,  $CON(C_{1-4} \text{ alkyl})_2$  or  $C_{1-4}$  alkylene $CON(C_{1-4} \text{ alkyl})_2$ ,  $R^{26}$  represents  $C_{1-4}$  alkyl or  $C_{2-4}$  alkenyl,  $q$  is 1 or 2, and  $r$  is 1 or 2.

Preferred deterrents employed according to the third aspect of the present invention are one or more of eugenol (4-allyl-2-methoxyphenol), limonene (4-isopropyl-1-methyl-cyclohex-1-ene), DEET (N,N-diethyl-m-toluidine), DEPA (N,N-diethyl-phenyl-acetamide), DMP (dimethylphthalate) and thymol (5-methyl-2-isopropylphenol).

The above described deterrents are generally olfactive, volatile compounds. However, according to a fourth aspect of the present invention a non-volatile deterrent may be used in a composition according to the present invention. Suitably, a non-volatile deterrent for use in the present invention comprises a tetrnortriterpenoid, such as azadirachtin or the like. A non-volatile deterrent of this type may be advantageous in facilitating preparation of a composition according to the present invention, for example facilitating incorporation into a molluscicidal pellet or the like.

Preferably, a deterrent employed in the present invention is one or more of a monohydric C<sub>6-10</sub> alcohol or a compound of formula (I), (III), (IV) or (VI). Preferred deterrents for use in the present invention include any of eucalyptol (1,3,3-trimethyl-2-oxabicyclo[2.2.2]octane), octan-1-ol, borneol (*endo*-1,7,7-trimethylbicyclo[2.2.1]heptan-2-ol), camphor (1,7,7-trimethylbicyclo[2.2.1]heptan-2-one), sulcatol (6-methyl-5-hepten-2-ol), sulcatone (6-methyl-5-hepten-2-one), and D-3-carene (3,7,7-trimethylbicyclo[4.1.0]hept-3-ene).

The most preferred deterrents for use in the present invention include any of borneol (*endo*-1,7,7-trimethylbicyclo[2.2.1]heptan-2-ol), camphor (1,7,7-trimethylbicyclo[2.2.1]heptan-2-one), sulcatol (6-methyl-5-hepten-2-ol), sulcatone (6-methyl-5-hepten-2-one), and D-3-carene (3,7,7-trimethylbicyclo[4.1.0]hept-3-ene).

A deterrent employed in the present invention is suitably employed against invertebrates which are themselves important natural control agents for a number of crop pests, including molluscs. In particular, these non-target invertebrates can include insects, such as beetles, especially carabid beetles or the like.

Further ingredients which may be present include proteins, carbohydrates or the like, or surfactants, binders or the like. Such further ingredients may be bait materials (such as, for example, a yeast extract), which are attractive to slugs, or materials which act as foods for slugs.

Generally, a composition according to the present invention further comprises at least one inert carrier. The term "inert carrier" as used herein refers to a carrier suitable for use in molluscicidal compositions, which does not substantially adversely interact with the deterrent or molluscicide, or any other ingredients. The "inert carrier" may have a positive effect in that it may itself be attractive to slugs. An example of such a carrier is a starch, which is also a food for slugs.

Typically, inert carriers suitable for use in compositions according to the present invention comprise materials that can be intimately mixed with the deterrent and molluscicide suitable for use according to the present invention, together with any other optional ingredients which may be present. Intimate mixtures of the molluscicide, deterrent and one or more inert carrier, can suitably be shaped into conventional forms, such as pellets, blocks, pads or tapes, for use in accordance with the present invention. When pellets are used in accordance with the present invention, they are generally of a size of the order of substantially 2 by 5 mm.

There is further provided by the present invention a pellet comprising a molluscicidal composition substantially as herein before described, and optimally further comprising one or more inert carriers for the deterrent and molluscicide.

According to the present invention there is further provided use of a molluscicidal composition substantially as herein before described in destroying molluscs, and in particular destroying slugs, such as slugs of the species *Deroceras reticulatum*.

The present invention further provides use of a molluscicide in destroying molluscs, wherein the molluscicide is used in combination with at least one deterrent for non-target invertebrates. This use according to the present invention is suitably employed in destroying slugs substantially as described above.

The present invention further provides a method of destroying molluscs, which method comprises providing molluscs with a molluscicidal composition substantially as herein before described, and allowing the molluscs to ingest the molluscicidal composition.

There is also provided by the present invention a method of treating an environment with a molluscicidal composition substantially as herein before described, so as to effect substantial eradication of molluscs from the environment. Typically, the environment treated by a composition according to the present invention (referred to below as a treatment environment) is an arable area or pasture, a glasshouse, an area of ornamental plants or forestry seedlings or the like. Alternatively a composition according to the present invention may be employed in treating domestic or public gardens so as to substantially eradicate molluscs therefrom.

There is further provided by the present invention a method of deterring non-target invertebrates (and in particular the carabid beetle), from ingesting a molluscicide which has been employed in a treatment environment as described above, which method comprises treating the environment with a molluscicidal composition substantially as hereinbefore described, whereby the deterrent is present in sufficient quantity to substantially preclude ingestion of the molluscicide by the non-target invertebrates.

According to the present invention there is further provided a process of preparing a molluscicidal composition, which process comprises mixing at least one molluscicide for target molluscs and at least one deterrent for non-target invertebrates, so that deterrent incorporated in the composition has substantially no effect on target molluscs feeding on the composition and substantially precludes feeding on the composition by the non-target invertebrates.

Suitably a process according to the present invention optimally further comprises mixing the deterrent and molluscicide with one or more inert carriers therefor. Appropriately a process according to the present invention further comprises shaping the deterrent and molluscicide, and optimally the inert carrier, into a pellet, suitable for ingestion by molluscs.

The present invention further provides use of a molluscicide in the manufacture of a molluscicidal composition substantially as herein before described. The use comprises mixing the molluscicide with at least one deterrent for non-target invertebrates, and optionally one or more inert carriers therefor.

There is also provided use of at least one deterrent for non-target invertebrates in the manufacture of a molluscicidal composition substantially as herein before described. The use comprises mixing the deterrent with a molluscicide, and optimally further mixing with one or more inert carriers therefor.

According to yet a further aspect of the invention there is provided, in combination (for use in destroying molluscs):

at least one molluscicide for target molluscs; and

at least one deterrent for non-target invertebrates, whereby feeding target molluscs are substantially unaffected by the deterrent and non-target invertebrates are substantially precluded from feeding on the molluscicide by the deterrent.

The present invention will now be further illustrated by the following Example, which does not limit the scope of the invention in any way.

Example

Electrophysiological screening

Electroantennogram

The electroantennogram (EAG) equipment employed is illustrated in Figure 1, where (1) represents a microscope, (2) represents a stimulus pipette, (3) represents an applicator, (4) represents a stimulus controller, (5) represents an operating computer, (6) represents a start pedal, (7) represents an antennal preparation, (8) represents a manipulator and (9) represents an amplifier.

A carabid, partially anaesthetised through chilling, was placed under a microscope (1) and a single antenna removed by cutting at the base where it enters the head. An electrode was then inserted into the base of the antenna before being earthed, this serving as the "indifferent" or "reference" electrode.

The extreme tip of the antenna was removed before several sensillary hairs were positioned into the tip of the "recording" electrode using "leitz" micromanipulator (8). The recording glass electrode had previously been trimmed to be a tight fit over the tip of the antenna to prevent Ringer solution from leaking out over the preparation, causing background instability and interference. Both electrodes consisted of Ag/AgCl wire contained in glass microelectrodes and partially filled with Rhodnius Ringer solution.

A continuous stream of purified air was passed over the preparation at a rate of 1L/min. This was both generated and maintained by stimulus controller (4). Test chemicals were then introduced into this air stream for a 0.5 second period and subsequently delivered to the preparation. This was achieved by blowing air over a strip of paper, on which 10 µL of test chemical had previously been dosed. The filter paper was contained within stimulus pipette (2) which was then positioned into the centre of the air stream and test chemicals blown over antennal preparation (7). Before the chemicals were applied to preparation (7), hexane solvent was delivered to determine that no activity was induced by the solvent, therefore, signalling that any subsequent activity produced was a direct result of the test chemical.

An internal standard of 5% dimethyl trisulfide was also randomly applied throughout the course of screening, to eliminate the possibility of de-sensitisation of the preparation with time.

#### Taste Recordings

Non-volatile compounds were applied to gustatory chemoreceptors located on the maxillary and gustatory palps of the carabid. The test chemical was incorporated into an electrolyte in the recording electrode before being positioned over several sensillae. Any subsequent activity was stored onto computer through a specialised "delayed trigger" IADC interface box. Recordings from these sensillae produced coded responses comprising individual compound APs.

#### Feeding Trials

#### Maintenance of test animals

Carabid beetles were maintained in a controlled environment at 15°C, with a dark to light ratio of 16 hours dark to 8 hours light. Prior to feeding trials, the beetles were fed on a single blowfly maggot before being starved for a period of 5 days.

Slugs were also maintained in a controlled environment 15°C, 16 hour dark : 8 hour light ratio. Before testing the slugs were fed *ad lib* on potato and then starved for 24 hours.

Filter paper feeding trials

Pre-starved carabid beetles were placed in uncovered glass arenas (20cm diameter) containing two pieces of 2.5cm diameter filter paper, previously coated in 50% maggot serum. One of these paper discs was then dipped in 0.1mg/ml test chemical while the other remained untreated serving as the control. Before being placed into the arena, the filter paper was left for a period of 20 minutes to allow the solvent (n-hexane) to evaporate, each test had 10 replicates. The discs were then placed at opposite ends of the dish and moistened with distilled water. After a period of 24 hours the papers were removed and the area consumed calculated using image analysis software.

Slug feeding bioassays

Methiocarb-free slug pellets were placed in numbered positions on a glass plate, oven dried at 50°C and weighed. Six pre-weighed pellets were then placed in each of fifteen 9cm plastic petri dishes on two filter papers (Whatman No. 1). Each pellet was dosed with 1µL hexane solvent, thus serving as the control. The petri dishes were placed in the control environment room and the filter papers moistened with distilled water. One slug was placed in each dish and a piece of netting attached over the top to contain the slug but prevent build up of vapour from the volatile test material. After 24 hours the slugs were removed and the pellets replaced on the glass plate and re-dried. The dry weight of the pellet consumed by the slug during the test was then calculated by difference.

Results

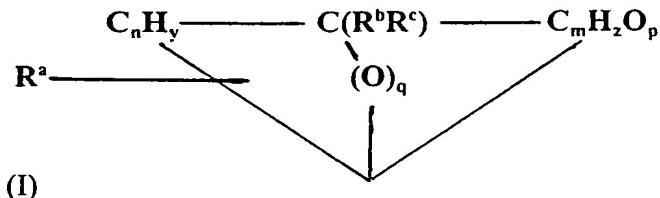
The following test compounds induced activity when screened on ten different preparations - camphor (1,7,7-trimethylbicyclo[2.2.1]heptan-2-one), borneol (*endo*-1,7,7-trimethylbicyclo[2.2.1]heptan-2-ol), octan-1-ol, eucalyptol (1,3,3-trimethyl-2-oxabicyclo[2.2.2]octane), β-myrcene (7-methyl-3-methylene-octa-1,6-diene), sulcatol (6-methyl-5-hepten-2-ol), sulcatone (6-methyl-5-hepten-2-one), eugenol (4-allyl-2-methoxyphenol), limonene (4-isopropyl-1-methyl-1-cyclo-hexene), DEET (N,N-diethyl-m-toluidine), DMP (dimethylphthalate), α-pinene (2,6,6-trimethylbicyclo[3.1.1]hept-2-ene), D-3-carene (3,7,7-trimethylbicyclo[4.1.0]hept-3-ene) and azadirachtin.

In the filter paper feeding trials the following compounds were tested for deterrent activity, and as such were identified as particularly useful deterrents for the present invention - borneol (*endo*-1,7,7-trimethylbicyclo[2.2.1]heptan-2-ol), camphor (1,7,7-trimethylbicyclo[2.2.1]heptan-2-one), sulcatol (6-methyl-5-hepten-2-ol), sulcatone (6-methyl-5-hepten-2-one), and D-3-carene (3,7,7-trimethylbicyclo[4.1.0]hept-3-ene).

Borneol (*endo*-1,7,7-trimethylbicyclo[2.2.1]heptan-2-ol), octan-1-ol, sulcatol (6-methyl-5-hepten-2-ol) and sulcatone (6-methyl-5-hepten-2-one) were also further tested in the slug feeding bioassays. None of these compounds substantially affected the slug feeding behaviour, as illustrated in Figures 2 and 3. In particular, sulcatol was tested at concentrations of 0.01, 0.1 and 1.0mg/ml and no detrimental effects on the slug feeding behaviour were seen.

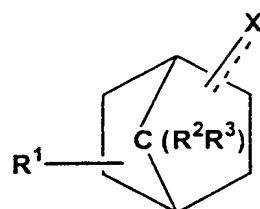
**Claims**

1. A molluscicidal composition comprising at least one molluscicide for target molluscs, and at least one deterrent for non-target invertebrates, wherein said deterrent is incorporated in the composition so as to have substantially no effect on target molluscs feeding on the composition and to substantially preclude feeding on the composition by the non-target organisms.
2. A molluscicidal composition according to claim 1, wherein said molluscicide is methiocarb.
3. A molluscicidal composition according to claim 1 or 2, wherein said deterrent comprises a bicyclic compound.
4. A molluscicidal composition according to claim 3, wherein said bicyclic compound is of the following general formula (I).

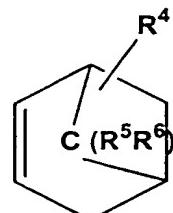


where n is 2 to 4, y is 2n or 2n-2, m is 0 to 3, z is 2m if p is 0 or 1, or z is m if p is 1, and q is 0 or 1; R<sup>a</sup>, R<sup>b</sup> and R<sup>c</sup> each independently represent hydrogen or C<sub>1-4</sub> alkyl. The oxygen in the C<sub>m</sub>H<sub>z</sub>O<sub>p</sub> group may be in a carbonyl group or a hydroxyl group, with appropriate values for m and z..

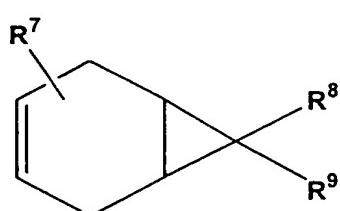
5. A molluscicidal composition according to claim 3, wherein said bicyclic compound is of the formula (II), (III), (IV) or (V)



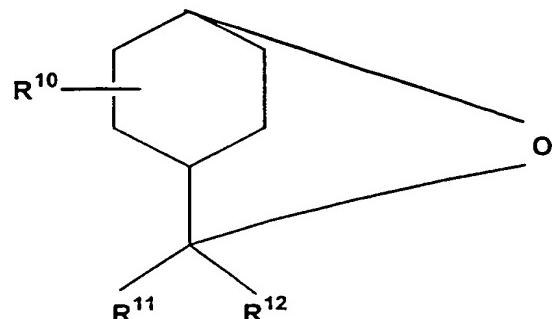
(II)



(III)



(IV)

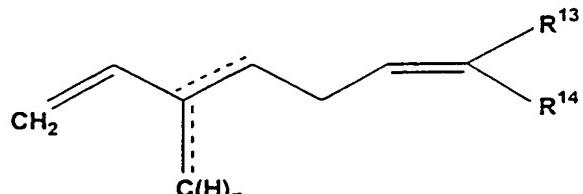


(V)

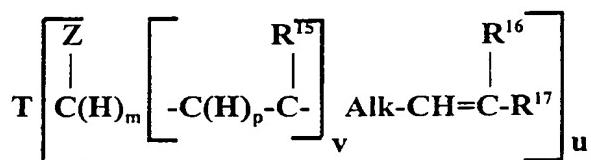
where R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸, R⁹, R¹⁰, R¹¹ and R¹² each independently represent hydrogen or C<sub>1-4</sub> alkyl, X represents oxygen or hydroxy and ----- represents a bond in the case where X represents oxygen.

6. A molluscicidal composition according to claim 3, wherein said bicyclic compound comprises camphor (1,7,7-trimethylbicyclo[2.2.1]heptan-2-one), borneol (*endo*-1,7,7-trimethylbicyclo[2.2.1]heptan-2-ol), eucalyptol (1,3,3-trimethyl-2-oxabicyclo[2.2.2]octane), α-pinene (2,6,6-trimethylbicyclo[3.1.1]hept-2-ene), or D-3-carene (3,7,7-trimethylbicyclo[4.1.0]hept-3-ene).

7. A molluscicidal composition according to claim 1 or 2, wherein said deterrent comprises a monohydric or polyhydric C<sub>6-10</sub> alcohol or a compound of formula (VI) or (VII)



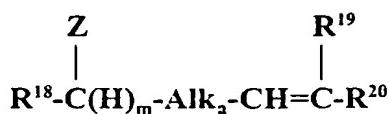
(VI)



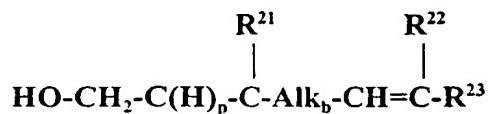
(VII)

where R<sup>13</sup>, R<sup>14</sup>, R<sup>15</sup>, R<sup>16</sup>, and R<sup>17</sup>, each independently represent C<sub>1-3</sub> alkyl, T is hydrogen or an aliphatic hydrocarbon group, Alk is a C<sub>1-3</sub> alkylene chain, Z is oxygen or hydroxy, n is 2 or 3, m is 0 or 1, v is 1 when T is hydrogen or 0 in all other cases, u is 1 or 2, p is 1 or 2 and ----- represents the optional presence of a bond.

8. A molluscicidal composition according to claim 7, wherein said deterrent is of formulae (VIII) or (IX)



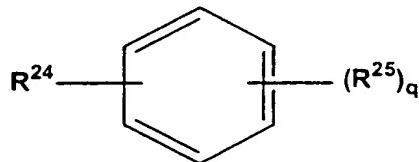
(VIII)



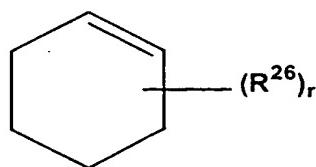
(IX)

where R<sup>18</sup>, R<sup>19</sup>, R<sup>20</sup>, R<sup>21</sup>, R<sup>22</sup>, and R<sup>23</sup> each independently represent C<sub>1-3</sub> alkyl, Alk<sub>a</sub> and Alk<sub>b</sub> independently represent a C<sub>1-3</sub> alkylene chain, Z is oxygen or hydroxy, m is 0 or 1, and p is 1 or 2.

9. A molluscicidal composition according to claim 7, wherein said deterrent comprises one or more of 2-ethylhexane-1,3-diol, citronellol (3,7-dimethyl-6-octen-1-ol), octan-1-ol,  $\beta$ -myrcene (7-methyl-3-methylene-octa-1,6-diene), nerol (*cis*-3,7-dimethyl-octa-2,6-dien-1-ol),  $\beta$ -ocimene (3,7-dimethyl-octa-1,3,6-triene), sulcatol (6-methyl-5-hepten-2-ol), sulcatone (6-methyl-5-hepten-2-one) and lycopene or a material containing lycopene..
10. A molluscicidal composition according to claim 1 or 2, wherein said deterrent comprises a substituted 6-membered carbocyclic ring, where the ring is either benzene or cyclohexene, and where the substituents are one or more of  $C_{1-4}$  alkyl,  $C_{2-4}$  alkenyl,  $C_{1-4}$  alkoxy, hydroxy,  $CO_2C_{1-4}$  alkyl,  $CON(C_{1-4} \text{ alkyl})_2$  and  $C_{1-4}$  alkylene $CON(C_{1-4} \text{ alkyl})_2$ .
11. A molluscicidal composition according to claim 10, wherein said deterrent is of formulae (X) or (XI)



(X)



(XI)

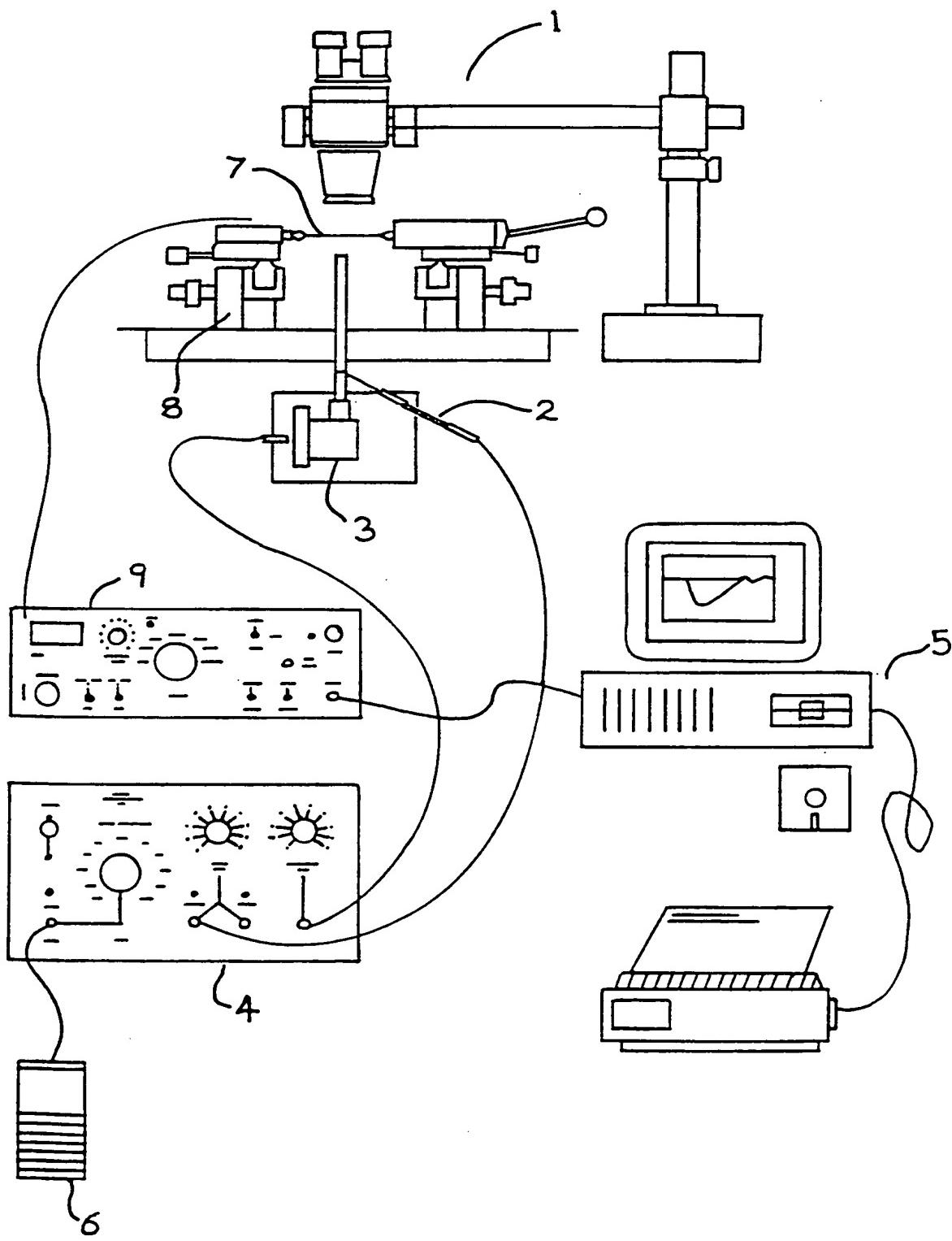
where  $R^{24}$  represents hydrogen,  $C_{1-4}$  alkyl or  $C_{2-4}$  alkenyl,  $R^{25}$  represents  $C_{1-4}$  alkyl,  $C_{1-4}$  alkoxy, hydroxy,  $CO_2C_{1-4}$  alkyl,  $CON(C_{1-4} \text{ alkyl})_2$  or  $C_{1-4}$  alkylene $CON(C_{1-4} \text{ alkyl})_2$ ,  $R^{26}$  represents  $C_{1-4}$  alkyl or  $C_{2-4}$  alkenyl,  $q$  is 1 or 2, and  $r$  is 1 or 2.

12. A molluscicidal composition according to claim 10, wherein said deterrent comprises one or more of eugenol (4-allyl-2-methoxyphenol), limonene (4-isopropyl-1-methyl-cyclohex-1-ene), DEET (N,N-diethyl-m-toluidine), DEPA (N,N-diethyl-phenyl-acetamide), DMP (dimethylphthalate) and thymol (5-methyl-2-isopropylphenol).

13. A molluscicidal composition according to claim 1 or 2, wherein said deterrent comprises a non-volatile compound.
14. A molluscicidal composition according to claim 13, wherein said non-volatile compound comprises a tetranostriterpenoid.
15. A molluscicidal composition according to any preceding claim, which includes bait material for target molluscs.
16. A molluscicidal composition according to any preceding claim, which includes food material for target molluscs.
17. A molluscicidal composition according to any preceding claim, which includes at least one inert carrier.
18. A molluscicidal composition according to any preceding claim, which is in the form of a pellet.
19. Use of a molluscicidal composition according to any preceding claim for destroying molluscs.
20. A method for destroying molluscs, which comprises providing said molluscs with a molluscicidal composition according to claim 1 to 18, wherein said mollusc is allowed to ingest said molluscicidal composition.
21. A method according to claim 20, wherein an environment is provided with said molluscicidal composition.

22. A process of preparing a molluscicidal composition which comprises mixing at least one molluscicide for target molluscs, and at least one deterrent for non-target invertebrates, said molluscicide and said deterrent being as defined in any of claims 1 to 14.
23. A process according to claim 22, in which said molluscicidal composition is mixed with at least one inert carrier.
24. A kit for use in destroying molluscs which comprises in combination at least one molluscicide for target molluscs; and at least one deterrent for non-target invertebrates, said molluscicide and said deterrent being as defined in any of claims 1 to 14.

FIGURE 1



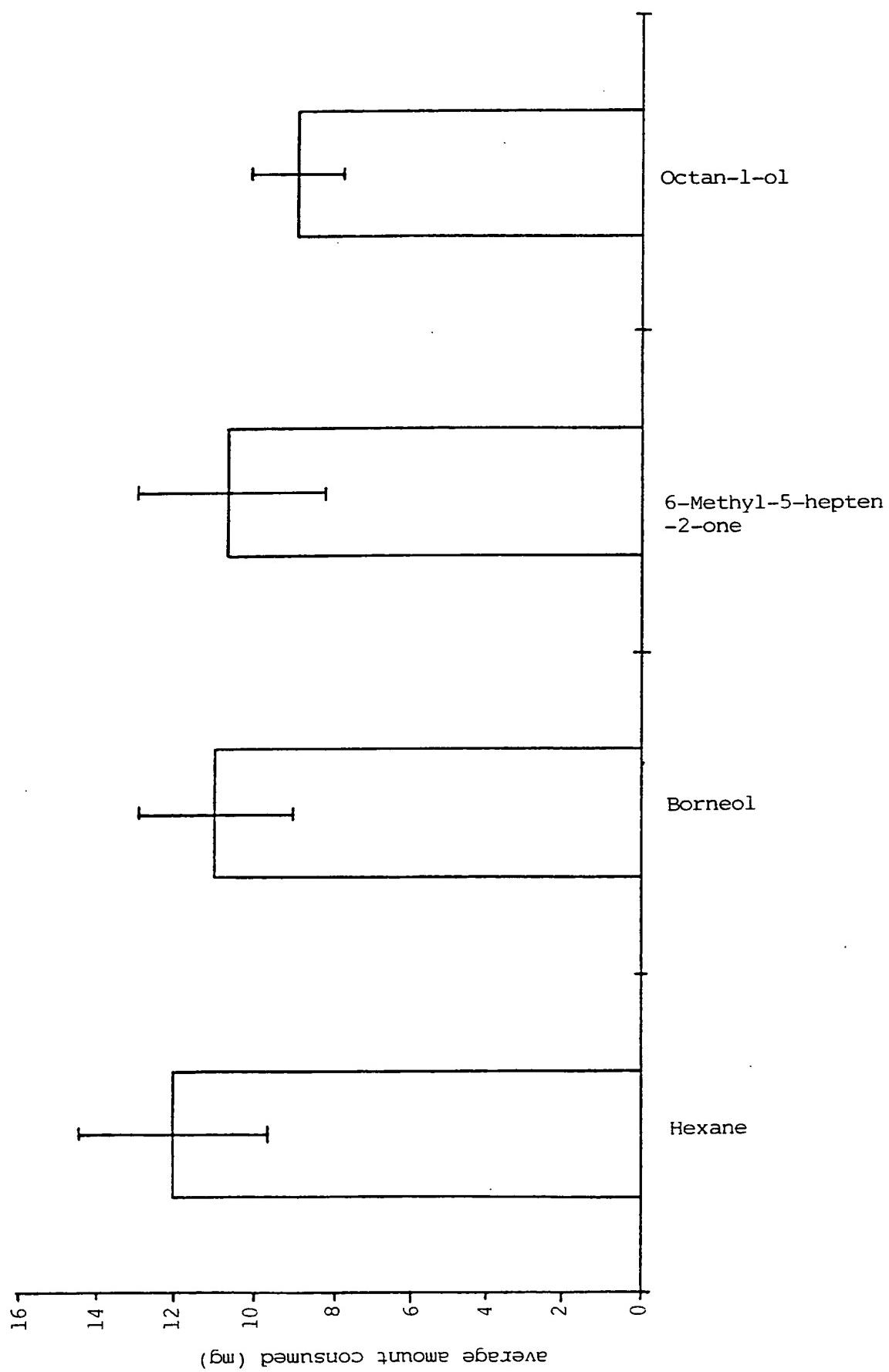
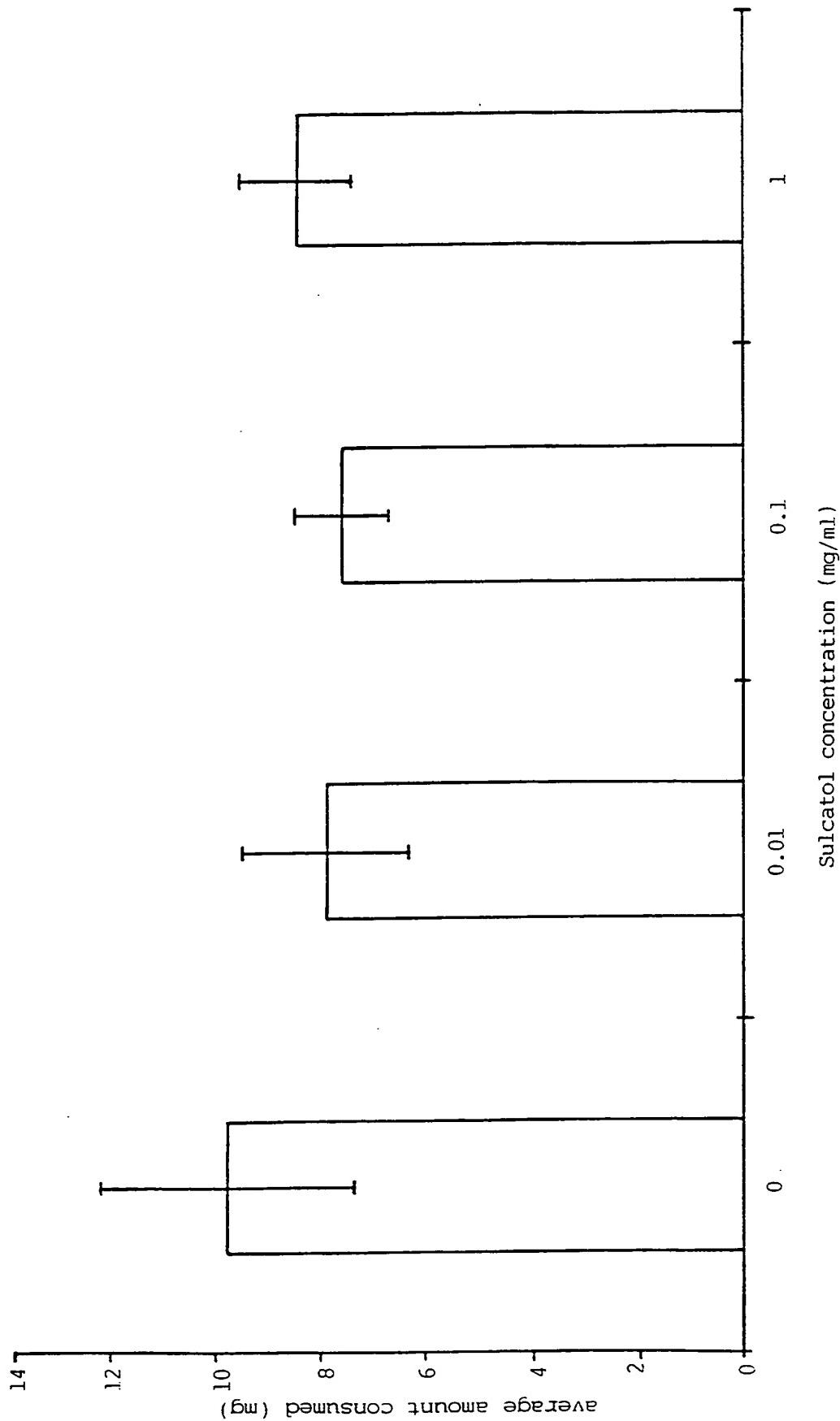


FIGURE 2

FIGURE 3



# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02394

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A01N47/22 A01N47/24 A01N25/00 // (A01N47/22, 65:00, 61:00,  
49:00, 43:90, 37:18, 37:10, 35:06, 35:02, 31:08, 31:06, 35:02, 31:08,  
31:06, 31:02, 27:00, 25:00), (A01N47/24, 65:00, 61:00, 49:00, 43:90,

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 41 11 389 A (BAYER AG) 15 October 1992 (1992-10-15) the whole document	1, 2, 13, 15-24
Y	---	1, 3-12, 14
Y	R.WEGLER: "Chemie der Pflanzenschutz- und Schädlingsbekämpfungsmittel, Band 1" 1970, SPRINGER, BERLIN, DE XP002121255 K.H.BÜCHEL: "Insekten-Repellents", pages 487 - 496 ---	1, 3-12, 14
Y	DE 40 12 224 A (HOLTMANN HEINRICH DR) 17 October 1991 (1991-10-17) page 2, line 3 - line 5 page 2, line 29 - line 59 ---	1, 3-12, 14
	-/-	

Further documents are listed in the continuation of box C.

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- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "P" document published prior to the international filing date but later than the priority date claimed

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Date of the actual completion of the international search

Date of mailing of the international search report

2 November 1999

22/11/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Lamers, W

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02394

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 37:18, 37:10, 35:06, 35:02, 31:08, 31:06, 31:02, 27:00, 25:00)

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**B. FIELDS SEARCHED**

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DATABASE WPI Section Ch, Week 199344 Derwent Publications Ltd., London, GB; Class C03, AN 1993-348296 XP002121258 & JP 05 255007 A (TUFTY GMBH), 5 October 1993 (1993-10-05) abstract --- WO 98 51150 A (BOWEN IVOR ; SANGOSSE UK S A DE (GB)) 19 November 1998 (1998-11-19) page 1, paragraph 1 page 3, paragraph 4 --- -/-/	1, 3-12, 14
P, X		1, 2, 11, 13, 15-24

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Date of the actual completion of the international search

Date of mailing of the international search report

2 November 1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.  
 Fax: (+31-70) 340-3016

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Lamers, W

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02394

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DATABASE WPI Section Ch, Week 198304 Derwent Publications Ltd., London, GB; Class C03, AN 1983-08680K XP002121259 & JP 57 203003 A (HOKKO CHEM IND CO LTD), 13 December 1982 (1982-12-13) abstract --- 	1-24
A	DATABASE WPI Section Ch, Week 198114 Derwent Publications Ltd., London, GB; Class A97, AN 1981-24453D XP002121260 & JP 56 015203 A (EARTH SEIYAKU KK), 14 February 1981 (1981-02-14) abstract --- 	1-24
A	DATABASE CABA 'Online' L.SAMSOE-PETERSEN ET AL.: "Interpretation of laboratory measured effects of slug pellets on soil dwelling invertebrates" retrieved from STN-INTERNATIONAL, accession no. 93:143105 CABA Database accession no. 931182382 XP002121256 abstract & ASPECTS OF APPLIED BIOLOGY, no. 31, 1992, pages 87-96, --- 	1-24
A	DATABASE CROPU 'Online' W.BUECHS ET AL.: "Studies on the Effect of Molluscicides on Some Carabid Beetles (Coleoptera: Carabidae) by Application in Different Laboratory and Semi-Field Tests" retrieved from STN-INTERNATIONAL, accession no. 91-83355 CROPU XP002121257 abstract & Z.ANGEW.ZOOL., vol. 77, no. 3-4, 1991, pages 479-500, ----	1-24

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International Application No

PCT/GB 99/02394

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
DE 4111389	A 15-10-1992	NONE		
DE 4012224	A 17-10-1991	NONE		
JP 5255007	A 05-10-1993	NONE		
WO 9851150	A 19-11-1998	AU 7438298 A		08-12-1998
JP 57203003	A 13-12-1982	NONE		
JP 56015203	A 14-02-1981	JP 1476800 C JP 63020802 B		27-01-1989 30-04-1988

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>P79844W0</b>	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 99/ 02394</b>	International filing date (day/month/year) <b>23/07/1999</b>	(Earliest) Priority Date (day/month/year) <b>23/07/1998</b>
Applicant <b>UNIVERSITY COLLEGE CARDIFF CONSULTANTS LTD ET AL.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
  - the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :
  - contained in the international application in written form.
  - filed together with the international application in computer readable form.
  - furnished subsequently to this Authority in written form.
  - furnished subsequently to this Authority in computer readable form.
  - the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
  - the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2.  Certain claims were found unsearchable (See Box I).

3.  Unity of invention is lacking (see Box II).

4. With regard to the title,

- the text is approved as submitted by the applicant.
- the text has been established by this Authority to read as follows:

5. With regard to the abstract,

- the text is approved as submitted by the applicant.
- the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.       

- as suggested by the applicant.
- because the applicant failed to suggest a figure.
- because this figure better characterizes the invention.

None of the figures.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02394

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 7 A01N47/22 A01N47/24 A01N25/00 // (A01N47/22, 65:00, 61:00,  
49:00, 43:90, 37:18, 37:10, 35:06, 35:02, 31:08, 31:06, 35:02, 31:08,  
31:06, 31:02, 27:00, 25:00), (A01N47/24, 65:00, 61:00, 49:00, 43:90,

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 41 11 389 A (BAYER AG) 15 October 1992 (1992-10-15) the whole document	1, 2, 13, 15-24
Y	---	1, 3-12, 14
Y	R.WEGLER: "Chemie der Pflanzenschutz- und Schädlingsbekämpfungsmittel, Band 1" 1970 , SPRINGER , BERLIN, DE XP002121255 K.H.BÜCHEL: "Insekten-Repellents", pages 487 - 496 ---	1, 3-12, 14
Y	DE 40 12 224 A (HOLTMANN HEINRICH DR) 17 October 1991 (1991-10-17) page 2, line 3 - line 5 page 2, line 29 - line 59 ---	1, 3-12, 14
		-/-

Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

2 November 1999

Date of mailing of the international search report

22/11/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Lamers, W

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02394

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 37:18, 37:10, 35:06, 35:02, 31:08, 31:06, 31:02, 27:00, 25:00)

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category <sup>*</sup>	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DATABASE WPI Section Ch, Week 199344 Derwent Publications Ltd., London, GB; Class C03, AN 1993-348296 XP002121258 & JP 05 255007 A (TUFFY GMBH), 5 October 1993 (1993-10-05) abstract ---	1, 3-12, 14
P, X	WO 98 51150 A (BOWEN IVOR ; SANGOSSE UK S A DE (GB)) 19 November 1998 (1998-11-19) page 1, paragraph 1 page 3, paragraph 4 --- -/-	1, 2, 11, 13, 15-24

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Date of the actual completion of the international search	Date of mailing of the international search report
2 November 1999	
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer  Lamers, W

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02394

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DATABASE WPI            Section Ch, Week 198304            Derwent Publications Ltd., London, GB;            Class C03, AN 1983-08680K            XP002121259            &amp; JP 57 203003 A (HOKKO CHEM IND CO LTD),            13 December 1982 (1982-12-13)            abstract            ---</p> <p>DATABASE WPI            Section Ch, Week 198114            Derwent Publications Ltd., London, GB;            Class A97, AN 1981-24453D            XP002121260            &amp; JP 56 015203 A (EARTH SEIYAKU KK),            14 February 1981 (1981-02-14)            abstract            ---</p> <p>DATABASE CABA 'Online!            L.SAMSOE-PETERSEN ET AL.: "Interpretation            of laboratory measured effects of slug            pellets on soil dwelling invertebrates"            retrieved from STN-INTERNATIONAL,            accession no. 93:143105 CABA            Database accession no. 931182382            XP002121256            abstract            &amp; ASPECTS OF APPLIED BIOLOGY,            no. 31, 1992, pages 87-96,            ---</p> <p>DATABASE CROPU 'Online!            W.BUECHS ET AL.: "Studies on the Effect of            Molluscicides on Some Carabid Beetles            (Coleoptera: Carabidae) by Application in            Different Laboratory and Semi-Field Tests"            retrieved from STN-INTERNATIONAL,            accession no. 91-83355 CROPU            XP002121257            abstract            &amp; Z.ANGEW.ZOOL.,            vol. 77, no. 3-4, 1991, pages 479-500,            -----</p>	1-24 1-24 1-24 1-24

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International Application No

PCT/GB 99/02394

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